SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

*SOME QUESTIONS OF NOMENCLATURE.**

INTRODUCTION.

I HAD originally selected for the address which it is my duty and privilege to give to-day a very different subject† from that which I am now to discuss; but the renewed and lively interest which is being manifested at present in the ever-troublous subject of nomenclature has led me to take it as my theme. I have been especially influenced, too, by the consideration that a committee was appointed at the last Zoological Congress, held at Leyden, to consider the subject, and suggestions have been asked for.‡ Of the multitudinous

*Address by Vice-President of Section F.—Zoology.

I avail myself of the opportunity to correct the proof of my address for SCIENCE, to add a few typographical corrections (not made in the proofs for the *Proceedings* of the Association) as well as some additional notes.

†Animals as Chronometers for Geology.

‡The Third International Zoological Congress, (Leyden Sept., 1895), appointed an International Commission of five members to study the various codes of nomenclature in use in different countries. This commission is composed of Dr. Raphael Blanchard (France), Prof. Carus (Germany), Prof. Jentink (Holland), Dr. Sclater, (England), and Dr. Stiles (United States). Dr. Stiles requested the appointment of an American Advisory Committee. This Advisory Committee has now been completed and is made up as follows:

"Dr. Gill, representing the National Academy of

questions that offer for review time will only permit us to examine a few.

Nomenclature, in the modern sense of the word, did not trouble naturalists till near the middle of the last century. The animals and plants of the Ancient world were mostly treated of under the names which the Greeks or Romans had used, or were supposed to have used. The forms that became first known after the discovery of America were introduced into the literature under names more or less like those which they bore among the aboriginal inhabitants of the countries from which those forms had been obtained. Only a few names were coined from the Latin or Greek, and used for forms not mentioned by classical authors. Examples of such are *Ammmodytes* and *Anarrhichas*, invented by Gesner. But none of those names were employed as true generic designations. Genera, in fact, in the strictest sense of the word, were not used, by zoologists at least,* till the time of Linnæus.

There were certainly very close approximations to the idea manifest in some of the older authors, such, for example, as Belon and Lang; but their analogous groups were not strictly defined and limited, as the genera of Linnæus and his followers were. The system has been one of slow growth, and has developed in accordance with our knowledge of Nature, and in response to the need for expressing the various degrees of complication of the organisms. The species known to the naturalists of early times were few in number—at least, comparatively—and the old students had no idea of the excessive diversity of form and structure familiar to us.

A census of animals and plants was taken by Ray, shortly before Linnæus commenced his career, and enumerated less than 4,000 animals, exclusive of insects; and of those it was estimated that there were about '20,000 in the whole world.' He evidently believed that the entire number living would not be found greatly to exceed this. But let Ray speak for himself.

According to the author's classification, animals were divided into four orders—'beasts, birds, fishes and insects.' The number of *beasts*, including also *serpents*, that had been accurately described, he estimated at not above 150, adding that, according to his belief, 'not many that are of any considerable bigness, in the known regions of the world, have escaped the cognizance of the curious.' (At the present day, more than 7,000 species of 'beasts,' reptiles, and amphibians have been described.*) The number of *birds* 'may be near 500; and the number of *fishes*, secluding shell-fish, as many; but, if the *shell-fish* be taken in, more than six times the number.' As to the species remaining undiscovered, he supposed 'the whole sum of beasts and birds to exceed by a third part, and fishes by one-half, those known.' The number of *insects*—that is, of animals not included in the above classes—he estimated at 2,000 in Britain alone, and 20,000 in the whole world. The number of *plants* described in Bauhin's 'Pinax' was 6,000; and our author supposed that "there are in the world more than triple that number; there being in the vast continent of America as great a variety of species as with us, and yet but few common to Europe, or perhaps Africk

Sciences; Dr. Dall, representing the Smithsonian Institution; Prof. Cope, representing the Society of American Naturalists; Prof. Wright, representing the Royal Society of Canada; Prof. Packard, representing the American Association for the Advancement of Science." (New note.)

*The genera of plants in Tournefort's work are perfectly regular, as well as defined and illustrated, but the nomenclature is certainly not binomial.

*In a recent estimate of described species, 2,500 species of manmals are enumerated and 4,400 species of reptiles and amphibians—the several classes thus aggregating 6,900; this is probably an underestimate. P. Z. S., 1896, 306. (New note.)

and Asia. And if, on the other side the equator, there be much land still remaining undiscovered, as probably there may, we must suppose the number of plants to be far greater. What," he continues, "can we infer from all this? If the number of creatures be so exceeding great, how great, nay, immense, must needs be the power and wisdom of Him who formed them all !"

About 375,000* species of animals are now known, and of insects we still know the smaller portion.†

As knowledge of species of animals and plants increased, the necessity of system in registering them became apparent. Linnæus and Artedi especially appreciated this necessity, and early applied themselves to the correction of existing evils and the reformation of the classification and nomenclature of all the kingdoms of Nature. The Latin language had been long the means of intercourse among the learned, and was naturally selected as the basis of nomenclature. Instead of Latin words used as equivalents or translations of vernacular, by Linnæus and Artedi they were taken especially and primarily for scientific use. The various *kinds* of animals became the more exact *genera* of naturalists. A new language, or rather vocabulary of proper names, was developed with the Latin as the basis. As no adequate idea was at first had of the magnitude of the subject, rigorous codes of laws were formulated on the assumption that philological questions were involved rather than the means for the expression of facts. But soon the bonds that had been framed for the restriction of the new vocabulary were broken. The idea dawned upon men that they had to do with natural objects rather than philological niceties, and that which was most conducive to facile expressions or exhibitions of facts was more to the purpose than Priscianic refinements. Linnæus himself eventually refused to be bound by the laws which he had originally framed. The early companion of Linnæus—Artedi—who had cooperated with him, and also framed a similar code for Ichthyology especially, was prematurely lost to science. The fact that Artedi devised the first code of laws affecting zoology has been generally overlooked, and a few of his 'canons' may be noticed here. The extent to which each one of the two—Linnæus and Artedi—influenced the other cannot now be learned, nor will it be necessary to consider here who of the two was the abler naturalist. It must suffice that there was almost perfect agreement between Artedi and Linnæus in the spirit of the laws they respectively framed.

*A census of animals recently taken under the superintendence of Dr. Sclater gave 386,000 species. P. Z. S., 1896, 307. (New note.)

†The late Dr. C. V. Riley even went so far as to say "that there are 10,000,000 species of insects in the world would be, in (his) judgment, a moderate estimate." The largest previous estimate, by Sharp and Walsingham, 2,000,000, was termed by Riley 'extremely low.'

COMMENCEMENT OF BINOMIAL NOMENCLATURE.

The question that has been most agitated of late is, what time shall we recognize as the starting-point for the binomial nomenclature? Even now not all will be bound by any such limit for generic nomenclature; but those who will are divided into two main camps—those who start from the tenth edition of the Linnæan 'Systema Naturæ,' published in 1758, in which the binomial nomenclature was first universally applied, and those who advocate the twelfth edition of the 'Systema,' published in 1766, the last which appeared during the life of Linnæus.

But it may be premised here that even the fact that Linnæus was the first to devise the system of binomial nomenclature is not conceded by all. It has been claimed that about two centuries before Linnæus published his 'Philosophia Botanica,' Belon

had uniformly and consistently applied the binomial nomenclature to plants as well as animals, fishes and birds.* It has been also urged that C. N. Lang (Langius),† in 1722, used the binomial nomenclature for shells. I have not been able to confirm either statement, and therefore have to side with the great majority who accord to Linnæus the credit of that achievement.

Almost all the naturalists of the United States accept 1758 as the starting-time for nomenclature, and now most of the naturalists of Europe take the same view. But the English generally accept 1766 for the commencement of their orismology. It was 'after much deliberation' that the Committee of the British Association for the Advancement of Science determined on the edition of 1766. It was only because that edition was 'the last and most complete edition of Linné's works, and containing many species that the tenth did not,' that it was so selected—surely an insufficient reason. A principle was subordinated to an individual.

Logically, the actual period for the commencement of the binomial nomenclature should be when the rules for that nomenclature were distinctly formulated; and that was 1751, when the 'Philosophia Botanica' was first published. Practically, however, it makes little difference for most classes,‡ whether we take that date or 1758, when the next succeeding edition of the 'Systema' was published. But it does make much difference whether we take the tenth or twelfth edition. There is really no good reason for keeping Linnæus on that lofty pedestal on which he was enthroned by his disciples of a past century. His work does not justify such an elevation. In every department of zoology contemporaries excelled him in knowledge and in judgment. May we not hope that, ultimately, this truth will be recognized, and the tenth edition universally accepted for the first work of the new era?

TRIVIAL NAMES.

The binomial system has come into prominence through a sort of developmental process. Although now generally regarded as the chief benefaction conferred by Linnæus* on biology, it was evidently considered by him to be of quite secondary importance.

The first extensive use of it occurs in the 'Pan Suecicus,' published in 1749, where the author mentions that to facilitate the recording of his observations he had used an 'epithet' in place of the differential character.† It was thus a mere economical device for the time being.

In the 'Philosophia Botanica' he also treats it as a matter of trivial importance. He distinguishes between the specific name and the trivial.

His *specific* name corresponds to what we

* Crié (Louis) Pierre Belon et la nomenclature binaire. Rev. Sc., xxx., 737–740, 9 Dec., 1882.

† My efforts to see a copy of Lang's 'Methodus nova Testacea marina in suas Classes, Genera, et Species distribuendi' (Lucern., 1722) have not been successful. Maton and Rackett say that 'he is the first whose generic characters are founded on commodious distinctions,' but expressly state that 'there are no trivial names.' (See Trans. Linn. Soc., vii., 156, 157.) He may have properly appreciated genera.

‡ Arachnology would be most affected, for Clerck's work was published in 1757.

* Linnæus himself did not claim this as an improvement in his account of the advancement he had effected in science.

† "Possumus nunc ultra duo millia experimenta certissima exhibere, quæ sæpe decies, immo sæpe bis decies sunt iterata. Si autem sumamus Floram Suecicam *Holmiæ*, 1745, & ad quamlibet herbam, ut chartæ parcatur, nomen adponimus genericum, numerum Floræ Suecicæ & epitheton quoddam loco differentiæ, negotium in compendium facile mittitur." Pan Suecicus, pp. 228, 229.

This thesis is attributed to Nicolaus L. Hesselgren in some bibliographies, and naturally so, as it bears his name in the title; but Linnæus probably did not claim more than his own in claiming the authorship, although Hesselgren apparently wrote part of it himself. It is sometimes difficult exactly to fix the authorship in the case of some of the old theses.

would call a *diagnosis* (Nomen specificum est itaque Differentia essentialis); his *trivial* name is what would now be called the *specific*.* It is merely suggested that trivial names may be used as in his 'Pan Suecicus,' and should consist of a single word taken from any source.†

This system was fully carried out in the succeeding editions of the 'Systema Naturæ.' Both names were then given—the *nomen specificum* after the number of the species, under each genus, and the *nomen triviale* before the number, in the margin.

Linnæus placed little store on the trivial names, and accredited such to old botanists; but he took special credit for specific names (or diagnoses), claiming that none worthy of the title had been given before him.‡

DRACONIAN LAWS.

For generic nomenclature a Draconian code was provided by Linnæus and Artedi. It is now a maxim of good legislation that excessive severity of law is apt to defeat the object sought for, and the tendency of civilization is to temper justice with mercy. So has the tendency of scientific advancement been towards a mitigation of the Linnæan code. Nevertheless, its severity is more or less reflected in later codes—even the latest—and therefore a review of some of those old canons will not be entirely a resurrection of the dead, and may contain a warning for the future.

In exclusiveness for generic names Linnæus and Artedi went far ahead of any of the moderns. They provided that no names were available for genera in zoology or botany which were used in any other class of animals or plants, or even which were used for minerals, tools, weapons, or other instruments, or even places.*

Under this rule such names as *Acus*, *Belone*, *Citharus*, *Hippoglossus*, *Lingula*, *Novacula*, *Orbis*, *Orca*, *Remora*, *Solea*, and *Umbra*—all now, or some time, in common use—were specified.

This rule was soon relaxed, and any name not previously used in zoology, or, at most, biology, was considered admissible.

Another rule sends to Coventry all names composed of two names of different animals, because it might be uncertain to which genus an animal really belongs.† The ancient name 'Rhino-Batus' is even mentioned as one of the delicts.

This rule is also without any justification, and the reason given for it baseless. Compound words of the kind exiled are in entire harmony with the genius of the classic languages. As an illustration of their use among the Greeks, we need refer to one group only—that is, compounds with hippos, as *Hippalectryon*, *Hippanthropos*, *Hippardion*, *Hippelaphos*, *Hippocampos*, *Hippotigris* and *Hippotragelaphos*. (*Hippokantharos*, *Hippomurmex*, *Hippopareos* and *Hipposelinon* are

* "217. Nomen specificum *legitimum* plantam ab *omnibus* congeneribus (159) distinguat; *Triviale* autem nomen legibus etiamnum caret." Phil. Bot., p. 202.

† "NOMINA TRIVIALIA forte admitti possunt modo, quo in *Pane suecico* usus sum; constarent hæc

Vocabula unico;

Vocabula libere undequaque desumto.

Ratione hac præcipue evicti, quod differentia sæpe longa evadit, ut non ubique commode usurpetur, et dein mutatione obnoxia, novis detectis speciebus, est, e. gr.

Pyrola [5 sp.]

Sed nomina Trivialia in hoc opere seponimus, de differentiis unice solliciti." Ph. Bot., pp. 202, 203.

‡ "Trivialia erant antecessorum et maxime Trivialia erant antiquissimorum Botanicorum nomina.

Character Naturalis speciei est *Descriptio; Character* vero *Essentialis* speciei est *Differentia.*

Primus incepi Nomina specifica Essentialis condere, ante me nulla differentia digna exstitit." Ph. Bot., p. 203.

* "Nomina piscium generica, quæ quadrupedibus pilosis, avibus, amphibiis, insectis, plantis, mineralibus, instrumentis opificum etc. communia sunt, omnino deleantur. Linn. Fund. 230." Art. Ph. Ich., § 193.

† "Nomina generica, ex uno nomine generico fracto, et altero integro composita, exulent. Linn. Fund. 224." Art. Ph. Ich., § 196.

other classic Greek words, but do not belong to the same category as the others, inasmuch as they were used in a sense analogous to horse-chestnut, horse-mackerel and horse-radish with us, the word 'horse' in this connection conveying the idea of strength, coarseness or bigness.)

In another rule, all words are proscribed as generic names which are not of Latin or Greek origin;* and among the proscribed are such names as *Albula*, *Blicca*, *Carassius* and many others, which were later used by Linnæus himself as specific names, and which are now used as generic denominations.

Words with diminutive terminations were barely tolerated, if admitted at all,† and the reason alleged for such treatment was that the cardinal name might belong to another class. Among the examples named were *Anguilla*, *Asellus*, *Leuciscus*, *Lingula*, *Oniscus*, and *Ophidion*, now familiar in connection with some of our best-known genera. One of these—*Ophidion*—was subsequently used by Linnæus himself as a generic name.

All are now tolerated without demur even, and probably by most naturalists never supposed to have been tainted with offense of any kind. For all such words we have also classical examples; and four have already been named—the *Oniscus* and *Ophidion* of the Greeks, adopted by the Romans, and the *Anguilla* and *Asellus* of the Latins.

Generic names, derived from Latin adjectives, were also declared to be unworthy of adoption. *Aculeatus*, *Centrine* and *Coracinus* were cited as examples of words that should be rejected under this rule. Later writers have repeated the denunciations uttered by Linnæus and Artedi, and refused to adopt such words. But hear what Plutarch says of names of men derived from adjectives.

In his life of Coriolanus, Plutarch, in recounting the events subsequent to the capture of Corioli, and the refusal of Marcius to accept more than his share of the booty, comes to the proposition of Cominius:†

"Let us, then, give him what it is not in his power to decline, let us pass a vote that he be called *Coriolanus*, if his gallant behavior at Corioli has not already bestowed that name upon him." Hence came his third name of Coriolanus, by which it appears that Caius was the proper name; that the second name, Marcius, was that of the family; and that the third Roman appellative was a peculiar note of distinction, given afterwards on account of some particular act of fortune, or signature, or virtue of him that bore it. Thus among the Greeks additional names were given to some on account of their achievements, as *Soter, the preserver*, and *Callinicus, the victorious;* to others, for something remarkable in their persons, as *Physcon, the gore-bellied*, and *Gripus, the Eagle-nosed;* or for their good qualities, as *Euergetes, the benefactor*, and *Philadelphus, the kind brother;* or their good fortune, as *Eudæmon, the prosperous*, a name given to the second prince of the family of the Batti. Several princes also have had satirical names bestowed upon them: Antigonus (for instance) was called *Doson, the man that will give to-morrow;* and Ptolemy was styled *Lamyras, the buffoon*. But appellations of this last sort were used with greater latitude among the Romans. One of the Metelli was distinguished by the name of *Diadematus*, because he went a long time with a bandage, which covered an ulcer he had in his forehead; and another they called *Celer*, because with surprising celerity he entertained them with a funeral show of gladiators a few days after his father's death. In our times, too, some of the Romans receive their names from the circumstances of their birth; as that of *Proculus*, if born when their fathers are in a distant country; and that of *Posthumus*, if born after their father's death; and when twins come into the world, and one of them dies at the birth, the survivor is called *Vopiscus*. Names are also appropriated on account of bodily imperfections; for amongst them we find not only *Sylla, the red*, and *Niger, the black*, but even *Cacus, the blind*, and *Claudius, the lame;* such

* "Nomina generica, quæ non sunt originis Latinæ vel Græcæ, proscribantur. Linn. Fund. 229." Art. Ph. Ich. § 198.

† "Nomina generica diminutiva vix toleranda sunt. Lind. Fund. 227." Art. Ph. Ich., §202.

† "Nomina generica imprimis Latina pure adjectiva, sed substantive usurpata, criticorum more improbanda sunt. Linn. Fund. 235." Art. Ph. Ich.' § 204.

persons, by this custom, being wisely taught not to consider blindness or any other bodily misfortune as a reproach or disgrace, but to answer to appellations of that kind as their proper names."

What was good enough for the ancient Romans to bestow on the most admired of their heroes is good enough for the nomenclature of our genera of animals. We have also examples of names of adjective form used substantively for animals among classic writers. Such, for example, are the *Aculeatus* (pipe-fish), and *Oculata* (lamprey or nine-eyes), mentioned by Pliny.

Linnæus himself, later, coined many names having an adjective form; and three of his genera of plants of one small family, so designated, occur in this region—*Saponaria*, *Arenaria* and *Stellaria*. Yet even at the present day we have evidences of the lingering of the old idea embodied in the canon in question.

We have also had drawn up for us certain rules for the conversion of Greek words into Latin, which are tinctured with more than Roman severity. Thus, we are told that Greek names ending in *-os* should always be turned into *-us;* that the final *-on* is inadmissible in the new Latin, and should invariably be rendered by *-um*.

In accordance with such rules, *Rhinoceros* has been turned into *Rhinocerus*, and *Rhinocerotidæ* into *Rhinoceridæ*. But *Rhinoceros* was admitted into classical Latinity, and with it the corresponding oblique cases, *Rhinocerotis*, etc.; in fact, the word was current in the language of description, satire, and proverb—as when used by Juvenal for a vessel made of the horn, or by Lucilius for a long-nosed man, or by Martial in the proverbial expression, 'Nasum rhinocerotis habere'; *i. e.*, to turn the nose up, as we would say. These authorities are good enough for me.

The termination *-on* was also familiar to the Romans of classic times, and numerous words with that ending may be found in the books of Pliny. But our modern purists will have none of them; the Greek *-on* in the new Latin must always become *-um*. For example, *Ophidion* was the name given to a small conger-like eel, according to Pliny, and was (without reason) supposed to have been applied to the genus now called *Ophidium;* and this last form was given by Linnæus, who eventually* refused to follow Pliny in such barbaric use of Latin. But Pliny is good enough for me—at least as a Latinist.

Another rule prohibits the use of such words as *Ægir*, *Göndul*, *Moho*, *Mitu*, *Pudu* and the like, and provides that they should have other terminations in accordance with classical usage. But why should those words be changed and surcharged with new endings? As they are, they are all uniform with classical words. *Ægir* has its justification in *Vir*, *Göndul* in *consul*, *Moho* in *homo* (of which it is an accidental anagram) and *Mitu* and *Pudu* are no more cacophonous or irregular than *cornu*. I therefore see no reason why we should not accept the words criticised and corrected by some naturalists in their original form, even if we consider the question involved as grammatical rather than one of scientific convenience.

I have thus defended some of the names of our old nomenclators, and really think the rules laid down for name-making were too severe. But those rules were on the whole judicious, and should not be deviated from by future nomenclators without good and substantial reason; even if too severe, they 'lean to virtue's side.' On the other hand, let old names be respected in the interests of stability, even if slightly misformed.

MISAPPLIED NAMES.

While Linnæus was so exacting in his rules of nomenclature in the cases cited, in

* At first (in the tenth edition) Linnæus allowed *Ophidion*.

others he was extremely lax. It is due to him (directly or indirectly) that our lists of genera of vertebrate animals especially are encumbered with so many ancient names that we know were applied to very different animals by the Greeks and Romans. It is Linnæus that was directly responsible for the misuse of such generic names of mammals as *Lemur*, *Manis*, *Dasypus;* such bird-names as *Trochilus*, *Coracias*, *Phaëton*, *Diomedea*, *Meleagris* and (partly with Artedi) such fish-names as *Chimæra*, *Centriscus*, *Pegasus*, *Callionymus*, *Trigla*, *Amia*, *Teuthis*, *Esox*, *Elops*, *Mormyrus* and *Exocœtus*. These all were applied by the ancients, to forms most of which are now well ascertained, and the animals to which they have been transferred have nothing in common with the original possessors of the names.

The misuse of these ancient names is in contravention of the rule adopted by the International Zoological Congress held in Moscow (1892), that "every foreign word employed as a generic or specific name should retain the meaning it has in the language from which it is taken," and of like rules of other associations. The false application by Linnæus and his followers (and he had many) was due partly to the belief that the ancient names were unidentifiable, but now there are few whose original pertinence is not known. It may be thought by some, however, that we are unduly criticising the doings of the past from the vantage-ground of the present. But such is not the case, for at the commencement of his career Linnæus was taken to task for the fault indicated. Some of those criticisms were so apt that they may be advantageously repeated here.

Dillenius, of Oxford, wrote to Linnæus in August, 1737, in these terms:

"We all know the nomenclature of Botany to be an Augean stable, which C. Hoffmann, and even Gesner, were not able to cleanse. The task requires much reading, and extensive as well as various erudition; nor is it to be given up to hasty or careless hands. You rush upon it, and overturn everything. I do not object to Greek words, especially in compound names; but I think the names of the antients ought not rashly and promiscuously to be transferred to our new genera, or those of the New World. The day may possibly come when the plants of Theophrastus and Dioscorides may be ascertained; and, till this happens, we had better leave their names as we find them. That desirable end might even now be attained if any one would visit the countries of these old botanists, and make a sufficient stay there; for the inhabitants of those regions are very retentive of names and customs, and know plants at this moment by their ancient appellations, very little altered, as any person who reads Bellonius may perceive. I remember your being told, by the late Mr. G. Gherard, that the modern Greeks give the name of *Amanita* (ἀμανίτα) to the eatable Field Mushroom; and yet, in *Critica Botanica*, p. 50, you suppose that word to be French. Who will ever believe the *Thya* of Theophrastus to be our *Arbor Vitæ?* Why do you give the name of Cactus to the *Tuna?* Do you believe the *Tuna*, or *Melocactus* (pardon the word), and the *Arbor Vitæ*, were known to Theophrastus? An attentive reader of the description Theophrastus gives of his *Sida*, will probably agree with me that it belongs to our *Nymphæa*, and indeed to the white-flowered kind. You, without any reason, give that name to the *Malvinda;* and so in various other instances concerning antient names, in which I do not, like Burmann, blame you for introducing new names, but for the bad application of old ones. If there were, in these cases, any resemblance between your plants and those of the antients, you might be excused, but there is not. Why do you, p. 68, derive the word *Medica* from the virtues of the plant, when Pliny, book xviii., chap. 16, declares it to have been brought from Media? Why do you call the *Molucca*, *Molucella?* It does not, nor ought it, to owe that name, as is commonly thought, to the Molucca islands; for, as Lobel informs us, the name and the plant are of Asiatic origin. Why then do you adopt a barbarous name, and make it more barbarous? *Biscutella* is not, as you declare, p. 118, a new name, having already been used by Lobel. I am surprised that you do not give the etymology of the new names which you or others have introduced. I wish you would help me to the derivation of some that I cannot trace; as *Ipomæa*, for instance. Why are you so offended with some words, which you denominate barbarous, though many of them are more harmonious than others of Greek or Latin origin?"

A year later (August 28, 1738) he again wrote:

"It would surely have been worth your while to visit Greece, or Asia, that you might become acquainted with, and point out to us, the plants of the antients, whose appellations you have so materially, and worse than any other person, misapplied. You ought to be very cautious in changing names and appropriating them to particular genera."

How entirely the previsions of the wise old botanist have been realized, I need not explain. We now know what almost all of the names misapplied by Linnæus and his school were meant for of old; and when some more good naturalists collect names and specimens together in various parts of Greece, probably very few of the ancient names will remain unidentifiable.

The only reply that Linnæus could make to the censures of Dillenius appears in the following minutes:

"With regard to unoccupied names in antient writers, which I have adopted for other well-defined genera, I learned this of you. You, moreover, long ago, pointed out to me that your own *Draba*, *Nova Pl. Genera* 122, is different from the plant so called by Dioscorides."

The retort of one sinner that his antagonist is another is no real answer.

The comments of the British Committee of 1865, on this subject, are very judicious and pertinent.

The use of mythological names for animals and plants is far less culpable. The use of such is no worse than that of any meaningless name. Sometimes, even, there may be conveyed an association of ideas which appeals to the imagination in a not disagreeable manner. For example, Linnæus gave the name *Andromeda*, after the Ethiopian maid whose mother's overgreat boasts of the daughter's beauty made her the victim of Poseidon's wrath. Linnæus justified his procedure by a remarkable play of fancy:

"This most choice and beautiful virgin gracefully erects her long and shining neck (the peduncle), her face with its rosy lips (the corolla) far excelling the best pigment. She kneels on the ground with her feet bound (the lower part of the stem incumbent), surrounded with water, and fixed to a rock (a projecting clod), exposed to frightful dragons (frogs and newts). She bends her sorrowful face (the flower) towards the earth, stretches up her innocent arms (the branches) toward heaven, worthy of a better place and happier fate, until the welcome Perseus (summer), after conquering the monster, draws her out of the water and renders her a fruitful mother, when she raises her head (the fruit) erect."

The relation of the old myth to the plant may be far fetched, and no other would ever be likely to notice the analogy without suggestion; but at least the conceit is harmless, if not agreeable.

The analogy that gave rise to this fanciful description, contained in the 'Flora Lapponica,' suggested itself to Linnæus on his Lapland journey:

"The Chamædaphne of Buxbaum was at this time in its highest beauty, decorating the marshy grounds in a most agreeable manner. The flowers are quite blood-red before they expand, but when full grown the corolla is of flesh-color. Scarcely any painter's art can so happily imitate the beauty of a fine female complexion; still less could any artificial color upon the face itself bear comparison with this lovely blossom. As I contemplated it, I could not help thinking of Andromeda as described by the poets; and the more I meditated upon their descriptions, the more applicable they seemed to the little plant before me; so that, if these writers had had it in view, they could scarcely have contrived a more apposite fable. Andromeda is represented by them as a virgin of most exquisite and unrivalled charms; but these charms remain in perfection only so long as she retains her virgin purity, which is also applicable to the plant, now preparing to celebrate its nuptials. This plant is always fixed on some little turfy hillock in the midst of the swamps, as Andromeda herself was chained to a rock in the sea, which bathed her feet, as the fresh water does the roots of the plant. Dragons and venomous serpents surrounded her, as toads and other reptiles frequent the abode of her vegetable prototype, and, when they pair in the spring, throw mud and water over its leaves and branches. As the distressed virgin cast down her blushing face through excessive affliction, so does the rosy-colored flower hang its head, growing paler and paler till it withers away. Hence, as this plant forms a new genus, I have chosen for it the name of *Andromeda*."

DOUBLE NAMES.

It was long the custom, when a specific

name was taken for a genus, to substitute a new specific for the one so diverted. There was some reason for this, for sometimes the specific name covered several forms, or at least was equally applicable to several; of late, however, the acceptance of both the generic and specific names, that is, the duplication of a name, has been quite general, and various precedents have been adduced in favor of the procedure. "In the solemn anthem musicians have been known to favor such repetitions, the orator uses them, in poetry they occur without offence, and even our English aristocracy sometimes bears them as an added grace."* It is also a frequent custom in many barbarous and half-civilized races, as well as the young of our own, to double the name for a given subject; and this analogy may be regarded by some of you as a perfect one. But in the last cases some regard is had for euphony, and it is a short word that is repeated, as in the case of the Kiwi-Kiwi and Roa-Roa of the Maoris of New Zealand. the Pega-Pega of the indigenes of Cuba, the Willie-Willie (water spout) of the Australians, and our own familiar Pa-pa and Ma-ma. Many scientific names repeated are long—some very long—but even for such I would now yield the point. Stability of nomenclature is a greater desideratum than euphony or elegance. But here let me add that there is a history behind the *Scomber Scomber*, which has been frequently cited as an example of the duplication of a name by Linnæus. It was *Scomber Scombrus* that was used at first by the early nomenclator, and that occurs in the tenth edition of the 'Systema Naturæ' (p. 297), as well as in the 'Fauna Suecica' (2d ed., p. 119). Linnæus thus combined the old Latin and Greek names of the mackerel, which were formally different, although of course traceable to one and the same root. The name is therefore not repulsive, but interesting as a historical reminiscence of past usage by two great peoples. It was only in the twelfth edition of the 'Systema' (p 492) that Linnæus exactly duplicated the name as *Scomber Scomber*, and thus vitiated the last edition in this as he did in other cases. But it is at least possible that the exact duplication of names in the twelfth edition is the off-spring of typographical inaccuracy or clerical inadvertence.* At any rate, those who recognize the tenth edition of the 'Systema' as the *initium* of nomenclature will adopt the more elegant form.

*Stebbing in Nat. Science, viii. 255.

VARIANTS AND SIMILARITY OF NAMES.

The case of *Scomber* and *Scombrus* naturally suggest consideration of another rule adopted by various societies. By the German Zoological Society it is provided that "names of the same origin, and only differing from each other in the way they are written, are to be considered identical."† Words considered identical are *Fischeria* and *Fisheria*, as well as *Astracanthus* and *Astera-*

*In the last part of the Proceedings of the Zoological Society of London (1896, II.) received, September 5th, the suggestion that *Scomber Scomber* was a lapsus is confirmed. According to Dr. Sclater, "on referring to the two copies of the twelfth edition, formerly belonging to Linnæus himself, and now in the library of the Linnæan Society, it will be found that the second *Scomber* is altered, apparently in Linnæus' own handwriting, into *Scombrus* (See note on this subject, 'Ibis,' 1895, p. 168)." P. Z. S. 1896, 310, 311. (New note.)

† "Etymologisch gleich abgeleitete und nur in der Schreibweise von einander abweichende Namen gelten als gleich.

Beispiele: *silvestris = sylvestris; cæruleus = cæruleus; linnæi = linnei; Fischeria = Fisheria; Astracanthus = Asteracanthus.*

a. Dagegen können neben einander verwendet werden *Picus* und *Pica; Polyodon, Polyodonta,* und *Polyodontes; fluvialis, fluviatilis, fluviaticus, fluviorum; moluccensis* und *moluccanus.*

b. Bei Neubildung von Namen möge man solche vermeiden, welche leicht mit schon vorhandenen verwechselt werden können." Regeln * * * von der Deutsch. Zool. Ges., § 4.

canthus; and among words sufficiently different are *Polyodon*, *Polyodonta*, and *Polyodontes*.

When rules are once relaxed in this indefinite manner, the way is at once open to differences of opinion as to what are to be considered identical or too much alike. *Fischeria* and *Fisheria* appear to me to be sufficiently distinct, and would be so considered by some who think that *Polyodon*, *Polyodonta*, and *Polyodontes* are too nearly alike. While the last three are conceded to be sufficiently distinct by the German Zoological Society, analogous forms, as *Heterodon* and *Heterodontus*, are claimed by some zoologists to be too similar, and consequently the latter prior and distinctive name of the 'Port Jackson shark' is sacrificed in favor of the later and inapt *Cestracion*—a name originally coined and appropriate for the hammer-headed sharks, but misapplied to the Australian shark.

I agree with those who think that even a difference of a single letter in most cases is sufficient to entitle two or more generic names so differing to stand. The chemist has found such a difference not only ample but most convenient to designate the valency of different compounds, as ferricyanogen and ferrocyanogen. I am prepared now to go back on myself in this respect. In 1831 Prince Max of Nieuwied named a bird *Scaphorhynchus*, and in 1835 Heckel gave the name *Scaphirhynchus* to a fish genus.* In 1863 I used a new name (*Scaphirhynchops*) for the acipenseroid genus, and that name was adopted by other naturalists. Jordan later considered the literal differences between the avine and piscine generic names to be sufficient for both. I yield the point, and abandon my name *Scaphirhynchops*. But those who hold to the rule in question will retain it.

Another set of cases exhibiting diversity of opinion may be exemplified.

In 1832 Reinhardt gave the name *Triglops* to one cottoid genus, and in 1851 Girard named another *Triglopsis*, Girard apparently not knowing of Reinhardt's genus. In 1860 the later name was replaced by *Ptyonotus*. All American naturalists have repudiated the last name.

In 1854 Girard named a genus of Atherinids *Atherinopsis*, and in 1876 Steindachner, knowing well the name of Girard, deliberately called a related genus *Atherinops*. No one, as yet, has questioned the availability of the later name, but one who refuses to adopt *Triglopsis* because of the earlier *Triglops* must substitute another name for *Atherinops*.

Who shall decide in such cases, and what shall be the standard?

MAKING OF NAMES.

It was long ago recognized, even by Linnæus, that the rigor of the rules originally formulated by him would have to be relaxed. Naturalists early began to complain that the Greek and Latin languages were almost or quite exhausted as sources for new names, and many resorted to other languages, framed anagrams of existent ones, or even played for a jingle of letters.

Forty years ago one of the most liberal of the American contributors to such names* defiantly avowed that "most of the genera [proposed by him] have been designated by words taken from the North American Indians, as being more euphonic than any one [he] might have framed from the Greek. The classic literature has already furnished so many names that there are but few in-

*In lieu of explanations of the etymology it may be assumed that *Scaphirhynchus* was derived from σκἀφειά, a digging or hoeing, and that *Scaphorhynchus* is from σκάφος, anything hallowed, as a boat. (Oct., 1896.) Both *Scaphorhynchus* and *Scaphirhynchus* were derived from 'σκάφη, scapha; ῥυγχος, rostrum' by Agassiz in in his Nomenclator Zoologicus, but the characters of the respective genera would be better expressed by the etymologics here suggested, the bird genus having a bill like an inverted boat and the fish genus a snout like a spade as the popular name—shovel-illed sturgeon—implies.

*Girard in Proc. Acad. Nat. Sc. Phila., viii., 209, 1856.

stances in which a name might yet be coined, and express what it is intended to represent. [He offered] this remark as a mere statement, not as an apology." He gave such names as *Minomus*, *Acomus*, *Dionda*, *Algoma*, *Algansea*, *Agosia*, *Nocomis*, *Meda*, *Cliola*, *Codoma*, *Moniana*, *Tiaroga*, *Tigoma*, *Cheonda* and *Siboma*.

The names have caused some trouble, and have been supposed to be original offspring of the ichthyologist; but those familiar with Longfellow's Hiawatha will recognize in *Nocomis* the name of the daughter of the Moon* and mother of Wenonah† (Nokomis), corrected by classical standard! and in *Meda* the title of a 'medicine man' (not 'a classical feminine name'). Other names are geographical or individual.

In the excellent report to the International Zoological Congress, by Dr. Raphael Blanchard (1889), it was remarked that it would be generally conceded that naturalists have almost completely exhausted the Greek and Latin words, simple and compound, possible to attribute to animals.‡

But the classic languages are even yet, although about one hundred thousand names§ grace or cumber the nomenclators, far from being completely exploited. To some of us, indeed, the difficulty in determining upon a new name is rather that of selection of several that are conjured up by the imagination rather than the coining of a single one.

Besides the methods of name-making generally resorted to, there are others that have been little employed. Among the few who have resorted to other than the regular conventional ways is the illustrious actual President of the American Association for the Advancement of Science. His long list of generic names proposed in the various departments of zoology embraces many of unusual origin, and almost always well formed, elegant and euphonious. I can only adduce a few of the ways of naming illustrated by classical examples.

In ancient Greek there are numerous words ending in *-ias*, and many substantives with that termination are names of animals given in allusion to some special characteristic.

Acanthias is the designation of a shark, especially distinguished by the development of a spine at the front of each dorsal fin; the name is derived from *ἄκανθα*, spine, and the terminal element.

Acontias is the name of 'a quick-darting serpent,' and the main component is *ἄκων*, a dart or javelin.

Anthias is the name of a fish found in the Mediterranean and distinguished by the brilliancy of its color; evidently it was based on *ἄνθος*, a flower. The color of the fish may remind one of a showy flower.

Xiphias is the ancient as well as zoological designation of the sword-fish; it was plainly coined from *ξίφος*, a sword.

These four names give some idea of the range of utility of the particle in question; they involve the ideas of defensive armature, offensive armature, ornamentation, and action.

A number of names have been framed by modern zoologists in conformity with such models. Such are *Stomias* (named by the Greek scholar and naturalist, Schneider) and *Ceratias*—types of the families *Stomiidæ* (generally written *Stomiatidæ*) and *Ceratiidæ*. *Tamias* is another name, well known in connection with the chipmunk.

But there is room for many more of like

* "From the full moon fell Nokomis,
Fell the beautiful Nokomis."
The song of Hiawatha, III., lines 4, 5.

†Ophiologists will recognize in Wenonah the source of a synonym (*Wenona*) given to the genus *Charina* by Baird and Girard. Oct., 1896.

‡ "On conviendra que les naturalistes ont dû épuiser à peu près complètement la liste des mots grecs ou latins, simple ou composés, qu'il était possible d'attribuer aux animaux." Bul. Soc. Zool. France, XIV., 223.

§ The number one hundred thousand includes duplicates and variants.

structure. For example, peculiarities of various parts might be hinted at by such words as *Carias* or *Cephalias* or *Cotidias* or *Cottias* (for animals having some distinctive character in the head), *Chirias* (hand or hand-like organ, *Gnathias* (jaw), *Podias* (feet), *Thoracias* (thorax), and many others of analogous import.

Another termination which might be used advantageously instead of the too often used *-oides* is the patronymic suffix *-ides*. This would be specially useful where genetic relationship is desired to be indicated. We have many such models in classical literature, as Alcides, the son of Alcæus; Atrides, the son of Atreus; Pelides, the son of Peleus, Æacides; the grandson of Æacus, and the like.

Another source for help in name-making is in the several intensive Greek particles occurring as prefixes of various names. The chief of these prefxes are *agi-*, *ari-*, *da-*, *eri-*, *eu-*, and *za-*. *Eu-* has been so very often drafted into use that relief and variety may be found by resorting to the others.

Ari- (*Ἀρι-*) occurs often in classical words, as *ἀρίδακρυς*, very tearful, *ἀρίδηλος*, very plain, and *ἀριπρεπής*, very showy.

Da- (*Δᾶ*) is illustrated by such names as *δάσκιος* (daskios, shaded) and *δαφοινός* (daphoinos, deep red) — convert them, if you will, into *Dascius* and *Daphœnus*. Numerous names may be made on the model, although in classical Greek there are few.

Eri- (*Ἐρι-*) is used in the same way as *Ari-*, and is familiar in ancient Greek as a particle of such words as *ἐριαυγής* (very brilliant) and *ἐριαύχην* (with a high arched neck). The common large seal of northern Europe (*Erignanthus barbatus*) has received its generic name, based on the same model, on account of the depth of the jaws. Very few naturalists, however, have availed themselves of this particle for name-making, most of the words in the zoological nomenclature commencing with *Eri-* having other origins.

Za- (*Ζα-*) is met with in such words as *ζᾱής* (strong blowing), *ζᾱθερής* (very hot), *ζᾱχαλλής* (very beautiful), *ζάπλουτος* (very rich), *ζᾱπότης* (a hard drinker). The particle has been utilized in the composition of the generic name (*Zalophus*) of the common sea-lion, distinguished by its high sagittal crest (*ζά-* and *λόφος*, crest), familiar to menagerie visitors, and the residents and travellers in San Francisco. Professor Cope has also made use of it for several of his names.

We have been told by ancient writers that Cicero was a name derived from *cicer*, a vetch. According to Pliny, the name (like *Fabius* and *Lentulus*) was obtained on account of ancestral skill in cultivation of the plant; but, according to Plutarch, the original of the name was so called because he had a vetch-like wen on his nose.* Which one (if either) was the fact is of no material consequence. The etymological propriety of both is sanctioned by the suppositions of classical writers. There can then be no valid objection to other names formed on the model.

There is one rule which has been put in such a form (and without proper exceptions) that a number of names, improper according to classical standards, have been introduced. The rule is that the aspirate of Greek should be rendered by *h*. While this is true for the commencement of a name, it is not for the body, where it generally is suppressed, being sonant only after *p*, *t* or *k*. The Greeks, accordingly, wrote *Philippos* (*Φίλιππος*) and *Ephippus* (*Ἔφιππος*). In accordance with such models *Mesohippus* and *Orohippus* should have been called *Mesippus* and *Orippus*. *Protohippus* should have been *Prothippus*. *Epihippus* might by some be considered to be preoccupied by *Ephippus*, a genus of fishes. But, in my opinion, all the names should be

*Those familiar with the 'Spectator' may recall Addison's allusion to this (No. 59). See also Middleton's Life of Cicero.

retained as they are (if there is no other objection), on the assumption that more confusion would result from sacrifice of priority than of classical excellence.

From names as names, I proceed to the consideration of fitting them to groups.

TYPONYMS.

The question what is necessary to insure reception of a generic name is one of those concerning which there is difference of opinion. By some a definition is considered to be requisite, while by others the specification of a type is only required. But the demand in such case is simply that the definition shall be made. It may be inaccurate or not to the point; it may be given up at once, and never adopted by the author himself afterwards, or by any one else. Nevertheless, the condition is fulfilled by the attempt to give the definition. In short, the attempt is required in order that the competency (or its want) of the namer may be known, and if incompetency is shown thereby—no matter! The attempt has been made. The indication by a type is not sufficient.

Any one who has had occasion to investigate the history of some large group must have been often perplexed in determining on what special subdivision of a disintegrated genus the original name should be settled. The old genus may have been a very comprehensive one, covering many genera, and even families, of modern zoology, and of course the investigator has to ignore the original diagnosis. He must often acknowledge how much better it would have been if the genus had been originally indicated by a type rather than a diagnosis. Many naturalists, therefore, now recognize a typonym to be eligible as a generic name. Among such are those guided by the code formulated by the American Ornithologists' Union, to which reference may be made, and in which will be found some judicious remarks on the subject under 'Canon XLII.' Certainly it is more rational to accept a typonym than to require a definition for show rather than use. Nevertheless, I fully recognize the obligation of the genus-maker to indicate by diagnosis, as well as type, his conception of generic characters.

FIRST SPECIES OF A GENUS NOT ITS TYPE.

On account of the difficulty of determining the applicability of a generic name when a large genus is to be subdivided, it has been the practice of some zoologists to take the first species of a genus as its type. This, it has been claimed, is in pursuance of the law of priority. It is, however, an extreme, if not illegitimate, extension of the law, and has generally been discarded in recent years. But in the past it had eminent advocates, such as George Robert Gray in Ornithology, and Pieter Van Bleeker in Ichthyology. A few still adhere to the practice, and within a few months two excellent zoologists have defended their application of names by statements that the first species of the old genera justified their procedure. The contention of one involves the names which shall be given to the crayfishes and lobsters.

It is evident that the fathers of zoological nomenclature never contemplated such a treatment of their names, and the application of the rule to their genera would result in some curious and unexpected conditions. Let us see how some genera of Linnæus would fare. The first species of *Phoca* was the fur seal, the first species of *Mustela* the sea-otter, the first of *Mus* the guinea pig, and the first of *Cervus* was the giraffe. These are sufficient to show what incongruities would flow from the adoption of the rule.

CHOICE OF NAMES SIMULTANEOUSLY PUBLISHED.

There is another issue of nomenclature involving many genera. In the same work

different names have been given to representatives or stages of what are now considered the same genus. For example, Lacépède, in the third volume of his 'Histoire Naturelle des Poissons,' published two names, *Cephalacanthus* and *Dactylopterus*, the former given to the young and the latter to the adult stage of the flying gurnard. *Cephalacanthus* appeared on page 323, and *Dactylopterus* on page 325. *Dactylopterus* is the name that has been generally adopted for the genus, but some excellent naturalists now insist on the resurrection and retention of *Cephalacanthus*, for the reason that the latter was the first given name. In connection with an analogous case, it was urged that 'the law of primogeniture applies to twins.' There is a fallacy involved in such a comparison, which becomes obvious enough on consideration. In the case of twins, the birth of one precedes that of the other by a very appreciable interval of time. But in the case of names appearing in the same volume (issued as a whole) the publication is necessarily simultaneous. It is therefore, it appears to me, perfectly logical to take the most appropriate name, or to follow the zoologist who first selected one of the names. In the case of *Dactylopterus*, there would be the further advantage that the current nomenclature would not be disturbed.

It is interesting to note that those who have acted on the principle just condemned do not feel called upon to accept the first species of a genus as its type.

MAJOR GROUPS AND THEIR NOMENCLATURE.

Another subject to which I would invite your attention is the amount of subdivision of the animal kingdom which is expedient, and the nomenclature of such subdivisions.

Linnæus only admitted four categories—class, order, genus and species. These sufficed for most naturalists during the entire past century. Only one naturalist—Gottlieb Conrad Christian Storr—went into much greater detail; he admitted as many as eleven categories, which may be roughly compared with modern groups as follows:

Agmen	Rubrisanguia [=Vertebrata]	Subkingdom
Acies	Warm-blooded, Cold-blooded	Superclass
Class	Mammalia	Class
Phalanx	Pedata, Pinnepedia, Pinnata	Subclass
Cohors	Unguiculata, Ungulata	Superorder
Ordo		Order
Missus		Suborder
Sectio		Family
Coetus		Subfamily
Genus		Genus
Species		Species

These groups are really not exactly comparable with any of recent systematists, inasmuch as Storr proceeded from a physiological instead of a morphological base in his classification. The only work in which this classification was exhibited was in his 'Prodromus Methodi Mammalium,' published in 1780.

With this exception, the naturalists of the last century *practically* recognized only four categories—species, genera, orders and classes. Families were introduced into the system by Latreille. The word 'family,' it is true, was not unknown previously, but it had been used only as a synonym for order. In botany such usage even prevails, to some extent, at the present day, and persists as a heritage of the past. The French botanists used 'famille' as the equivalent of 'ordo.' Our English and American botanists followed and used 'order' as the more scientific designation, and 'family' as a popular one; Gray, for example, calling the family represented by the buttercups the 'Order Ranunculaceæ,' or 'Crowfoot Family.' But in zoology the two names became early differentiated and, while order was continued in use with the approximate limits assigned to it by Linnæus, family was interposed as a new category, intermediate between the order and

genus. At first this category generally was given a descriptive designation; but soon the tendency to employ, as a part of the designation, the stem of the principal generic name became marked, and the use of the patronymic suffix *-idæ* in connection with a generic name was adopted and, as time has advanced, has become more and more general. But the assent to this method is not universal. There are still some excellent zoologists who refuse to be bound by the rule, and who adopt the oldest family name, whether it be denominative or patronymic and whatever may be the termination.

The five categories thus recognized were very generally admitted, and for a long time were the only ones recognized by many naturalists. But gradually suborders, subfamilies and subgenera were taken up. Further, the word 'tribe' was often used, but with different applications. Still other divisions were occasionally introduced, but the most elaborate of all the schemes for gradation of the groups of the animal kingdom were those proposed by Bleeker* and Haeckel.† They are reproduced in the following parallel columns, in which their applications to fishes and mammals are likewise shown:

Vertebrata	Phylum		
Pachycardia	Subphylum		
Allantoidia	Cladus		
	Subcladus		
Mammalia	CLASSIS	CLASSIS	*Pisces*
Monodelphia	Subclassis	Subclassis	*Monopnoi*
		Divisio	*Dirhinichthyes*
Deciduata	Legio	Legio	*Eleutherognathi*
Discoplacentalia	Sublegio	Sublegio	*Ctneobranchii*
		Series	*Isopleuri*
		Subseries	*Kanonikodermi*
		Phalanx	*Alethinichthyes*
		Subphalanx	*Neopoiesichthyes*
		Caterva	*Katapieseocephali*
Rodentia	ORDO	ORDO	*Percæ*
	Subordo	Subordo	*Percichthyini* [sic!]
Myomorpha	Sectio	Sectio	*Paristemipteri*
	Subsectio		
		Tribus	*Percichthyini* [sic!]
Murina	FAMILIA	FAMILIA	*Percoidei*
	Subfamilia	Subfamilia	*Percæformes*
Arvicolida	*Tribus*	*Cohors*	
Hypudæi	*Subtribus*	Stirps	
Arvicola	GENUS	GENUS	*Perca*
	Subgenus		
Paludicola	*Cohors*		
	Subcohors		
Arvicola amphibius	SPECIES	SPECIES	*Perca fluviatilis*
	Subspecies		
Arvicola (amphibius) terrestris	Varietas		
Arvicola (amphibius terrestris) argentoratensis	Subvarietas		

Here we have a total of 31 categories intermediate between the kingdom and the individual of an animal form. The tools have become too numerous, and some were rarely used by the authors themselves. Thus the cohors and stirps were not called into requisition by Bleeker for the Percoidei (though they were for the subdivision of the Cyprinoidei), and in the recent classification of the Radiolarians, Professor Haeckel did not find it necessary to draw upon the tribus or subtribus for the arrangement of any family. None others have adopted in detail either of the elaborate schemes proposed by their distinguished authors, and even those authors themselves have not, in their later works, gone into the details they provided for in their schemes. The only divisional name that has been used to any great extent is tribe. That has been frequently employed, but in different ways—sometimes for the division of an order, sometimes within a suborder, sometimes for a section of a family, again for a part of a subfamily, and even for a fragment of a genus.* In two of these widely differ-

*Enumeratio specierum Piscium hucusque in Archipelago Indico observatorum, p. xi et seq.

†Generelle Morphologie der Organismen, II., 400.

*The words Phalanx, Cohors and Series (if not others) have been used recently in another manner by Dr. F. A. Smith in the 'History of Scandinavian Fishes.' The sequence in that work is Classis, Ordo, Subordo, Phalanx, Cohors, Series, Familia, Subfamilia, Genus, Subgenus, Species.

ing ways it has been used in the systems of Bleeker and Haeckel. It is evident, however, that more groups than the old conventional ones, which alone Agassiz admitted, would be useful at present. A happy mean seems to be realized in the following list:

Branch	Superfamily
Subbranch	Family
Superclass	Subfamily
Class	Supergenus
Subclass	Genus
Superorder	Subgenus
Order	Species
Suborder	Subspecies

There are only two (or three for trinomialists) of these which are 'sonant,' all the others being 'mute' (to use the expression of Linnæus); but a question of termination affects several of them.

All the supergeneric groups, like families, were originally chiefly designated by descriptive names, but the trend in all the years has been towards names which are based on the stems of existing genera.

FAMILY.

In 1796–7 ('an 5 de la R.'), Latreille, in his 'Précis des Caractères génériques des Insectes,' for the first time employed the term 'family' as a subdivision of an order, but only gave the families numbers ('Famille première,' 'Fam. 2,' etc.).* He remarked that it might be desirable to have the families named, but deferred doing so till he could review the subject with greater care.†

In 1798 ('an 6'), Cuvier, in his 'Tableau Élémentaire de l'Histoire naturelle des Animaux,' in the introduction, when treating of graded characters ('*caractères gradués*'), named only the genus, order, class, and the kingdom. In the body of the work, sometimes he used the word family instead of order (as for the Birds), but for two orders of the Insects he formally adopted a division into families which were regularly named. The first (unnamed) order ('ordre'), with jaws and without wings ('Des insectes pourvus de mâchoires, et sans ailes'), was divided into several families ('plusieurs familles naturelles')—'les Crustacés,' 'les Millepieds,' 'les Aracnéides,' and 'les Phtyréides.' The order Névroptères was disintegrated into three families ('trois familles naturelles')—'les Libelles,' 'les Perles,' and 'les Agnathes.' The representatives of the other (six) orders were distributed directly into genera.

This, so far as I have been able to discover, was the first time in which an order of the animal kingdom was regularly divided into named families, designated as such.

In 1806 Latreille, in his 'Genera Crustaceorum et Insectorum,' gave names to families, but on no uniform plan, providing descriptive names for some, as '*Oxyrhinci*' for the Maioidean crabs—names based on typical genera, with a patronymic termination, as *Palinurini* and *Astacini*, and, in other cases, names also based on a typical genus but with a quasi plural form, as *Pagurii*. (In the same work, it may be well to add, Latreille also admitted more categories than usual, using ten for the animal kingdom—Sectio, Classis, Legio, Centuria, Cohors, Ordo, Familia, Tribus, Genus and Species.)

In 1806 A. M. Constant Duméril, who had previously contributed tables of classification to Cuvier's 'Leçons d'Anatomie Comparée,' and published his own 'Elemens d'Histoire Naturelle,' brought out his 'Zoologie Analytique.' In this volume he gave analytical tables for the entire animal kingdom and admitted families for all the classes. The families were generally sub-

* "Les rapports anatomique, ceux de *l'Habitus*, des métamorphoses, ont été mes guides dans la formation des familles. Elles sont précédées d'un chiffre arabe." p. ix.

† "On eut désiré que j'eusse donné des noms aux familles; mais prévoyant que je serois contraint d'y faire plusieurs changemens, j'eusse ainsi exposé la nomenclature à une vicissitude très contraire à l'avancement de la science." p. ix.

ordinated to orders; but when the structural diversity within a class did not appear sufficient to require more than one 'mute' category the order was sacrificed in favor of the family. His families were generally very comprehensive, often very unnatural, and mostly endowed with descriptive names. (He admitted no more than five named categories in the animal kingdom—class, order, family, genus and species.)

As we have seen, Cuvier, Latreille, Rafinesque and others, to some extent, used names ending in *-ides* and *-ini;* but the first to fully recognize the advisability of using patronymic family names universally was William Kirby, who has not often received the credit for so doing, and is probably unknown to most in such connection. Nevertheless, in a note to his memoir on 'Strepsiptera, a new Order of Insects proposed,'* he explicitly introduced this important feature in systematic terminology. He complained that Latreille's names 'have not that harmony and uniformity of termination which is necessary to make them easily retained by the memory.' Continuing, he added, 'If we adopted a patronymic appellation for these sections, for instance, Coleoptera *Scarabæidæ*, Coleoptera *Staphylinidæ*, Coleoptera *Sphæridiadæ*, Orthoptera *Grylledæ*, etc., it would be liable to no objection of this kind.'

The suggestion thus made was heeded. The English naturalists (especially William Elford Leach and John Edward Gray) soon applied the method inculcated, and from them it has spread to the naturalists of every land; but the original impulse has been forgotten. For this reason I have recalled the memory of Kirby's work.

*The suggestion of Kirby is to be found in a footnote (p. 88) to the seventh memoir published in 'the Transactions of the Linnæan Society of London' (XI., 86–122, pl. 8, 9). The memoir was 'read March 19, 1811;' the date of the whole volume is 1815.

But it was long before the expediency of this procedure was universally recognized, and even yet there are dissentients. One objection was that the termination *-idæ* was not consistent with Latin words. Prof. Agassiz was never reconciled to such names, and gave names of Greek origin the termination *-oidæ*, and those of Latin the ending *-inæ*. In his system, too, there was no distinction between families and subfamilies, both having terminations in consonance with the origin of the stems, and not the taxonomic value of the groups.

The endings *-idæ* and *-oidæ* have been often supposed to be identical, and even in highly esteemed dictionaries (as 'The Imperial Dictionary of the English Language') the terminal element of family names ending in *-idæ* is derived from 'εἶδος, resemblance.' As already indicated, however, words so terminated should be considered as patronymics. But those ending in *-oidæ*, *-oidei*, and *-oidea* may be assumed to be direct components with εἶδος.

In answer to the objection (by Burmeister for example) that patronymic names are foreign to the genius of the Latin language, or at least of Latin prose, the fact that such a poet as Vergil has a large number shows that there is no pervading antagonism.

SUBFAMILY.

Next to the family, the term 'subfamily' was the earliest, and has been the one most generally accepted of the groups now adopted. But the name itself was not used till long after 'family' had come into general vogue. The chief subdivision of the family had been named tribe ('*tribu*'), by Latreille, in 1806, and he continued to use that term. C. S. Rafinesque, in 1815, used the word subfamily ('*sous-famille*') for groups of the same relative rank as the 'tribu' of Latreille, but gave generally descriptive names, with modified nominative plural endings (*e. g.*, *Monodactylia*), although

sometimes he named the group after the principal genus (*e. g.*, *Percidia*). The subfamily is now generally recognized, and its ending rendered by *-inæ*, or more seldom *ini* or *ina*. This is rather a termination for Latin adjectives involving the idea of relation or pertinence.

But, as been already urged, the language of nomenclature should not be bound by rules of strict philology. One of the most useful devices of scientific terminology is the establishment of terminations which indicate the nature or value of a group or relation to the group to which some entity belongs.

The chemist has his terminations in *-ates*, *-ides* and *-gens*, and does not deem it incumbent to defend his usage or to abandon his system, because some one might object to the want of classical models. Nay, classical scholars themselves have recognized the legitimacy and usefulness of such a method.

The ending *-idæ* has been shown to have classical sanction for both Greek and Latin; *-inæ* has only classical sanction for Latin words, and there is one— *-oidea* for which no models are to be found in either language. But the convenience of all those endings as indicative at once of the taxonomic value of each group far outweighs any objection to them from the philological side. We are now confronted with the groups having the *-oidea* ending.

SUPERFAMILY.

Experience has shown that for the exhibition of difference in value of various groups and characters, more than the generally accepted groups—families and subfamilies—are desirable. Groups above the family, in the generality of their characters, had been frequently adopted. A quarter century ago I searched for an available name and notation for such a group, and found that the groups which I wished to recognize were most like those that Dana had recognized in the Crustaceans, under the name of subtribe, and given the ending *-oidea*. But the term 'tribe' had first been given and most generally used for a subdivision of the family, and consequently was ineligible for a group including the family. Other names had been given to such groups, but there were objections against them. In a communication to the American Association for the Advancement of Science (Volume XX.) I used a new name—superfamily—and the termination *-oidea*. The great advantage of the name was that it relieved the memory, and suggested at once what was meant by relation to a familiar standard—family. The term has been quite generally adopted, but there has been diversity of usage in the form of the names, *-oideæ* being frequently suffixed to the stem, and sometimes a descriptive name has been given. The only reason for the ending *-oidea* is that it was first used in such connection; *-oideæ* has the advantage (or disadvantage?) that it is in consonance with *-idæ* and *-inæ*. No provision has been made by the German Zoological Society for this category, their attention having been confined to family and subfamily nomenclature.*

OTHER GROUPS

Time does not permit of the consideration of the other groups—order, suborder, class, subclass, superclass, branch, etc. Nevertheless, a caveat is in order that there appears to be no reason why the principle of priority now so generally recognized for the subordinate groups should not prevail

* "Die Namen von Familien und Unterfamilien werden fortan von dem gültigen Namen einer zu diesen Gruppen gehörigen Gattung Gebildet, und zwar die der Familien durch Anhängen der Endung *idæ* (Plural von *ides* [gr. εἰδης] masc. gen.), die der Unterfamilien durch Anhängen der Endung *inæ* (fem. gen.) an den Stamm des betreffenden Gattungsnamens." Regeln . . . von der Deutsch. Zool. Ges., § 28.

for the higher. Why should the name Amphibia disappear and Batrachia and Reptilia usurp its place? Amphibia is a far better name for the Batrachia, and in every way defensible for it. The name had especial relation to it originally, and it was first restricted to it as a class. Why should the names Sauria and Serpentes give place to Lacertilia and Ophidia? The first are names familiar to all and correctly formed; the last are, at least, strangely framed. Why should not Meantia be adopted as an ordinal name, by those who regard the Sirenids as representatives of a distinct order, as did Linnæus? Why should not the ordinal names Bruta, Feræ, Glires and Cete prevail over Edentata, Carnivora, Rodentia and Cetacea? If the rules formulated by the various societies are applied to those groups, the earliest names must be revived.

COMPLAINTS OF INSTABILITY OF NOMENCLATURE.

Frequent are the laments over the instability of our systematic nomenclature; bitter the complaints against those who change names. But surely such complaints are unjust when urged against those who range themselves under laws. We are forcibly reminded by such complaints of the ancient apologue of the wolf and the lamb. The stream of nomenclature has indeed been much muddied, but it is due to the acts of those who refuse to be bound by laws or reason. The only way to purify the stream is to clear out all the disturbing elements. In doing so, mud that has settled for a time may be disturbed, but this is at worst anticipating what would have inevitably happened sooner or later. We are suffering from the ignorance or misdeeds of the past. In opposing the necessary rectifications and the enforcement of the laws, extremes may meet; conservatives and anarchists agree. But the majority may be depended upon in time to subscribe to the laws, and the perturbed condition will then cease to be.

It is unfortunate that our nomenclature should have been so wedded to systematic zoology, and devised to express the different phases of our knowledge or understanding of morphological facts. Even under the binomial system the disturbing element might have been made much less than it is. The genera of Linnæus recognized for the animal kingdom were generally very comprehensive; sometimes, as in the case of *Petromyzon*, *Asterias* and *Echinus*, answering to a modern class; sometimes, like *Testudo*, *Rana*, *Cancer*, *Scorpio*, *Aranea*, *Scolopendra* and *Julus*, to a modern order, or even more comprehensive group, and rarely, among Vertebrates, to a group of less than family value. The usage of Linnæus for the animal kingdom was very different from that for the vegetable kingdom. If the successors of Linnæus had been content to take genera of like high rank (equivalent to families, for example), and give other names to the subdivisions (or subgenera) of such genera, which, to use the language of Linnæus, should be mute, less change would have subsequently resulted. But (Linnæus himself leading) his successors successively divided a genus, gradually accepting a lower and lower standard of value, till now a genus is little more than a multiform or very distinct isolated species. Yet the change has been very gradual. It began by taking a comprehensive group, recognizing that the differences between its representatives were greater than those existing between certain genera already established, and therefore the old genus was split up; or it was perceived that the characters used to define a genus were of less systematic importance than others found within the limits of the old genus, and, to bring into prominence such a truth, the genus was disintegrated. The

process often repeated, and from successively contracted bases, has led to the present condition.

The existing system of restricted genera, however, is too firmly fixed to revert back to a method that might have been, and which indeed Cuvier attempted to introduce by his revised Linnæan genera and their subgenera. The best thing to do now is to accept the current system, purified as much as possible by judicious and inexorably applied laws. Doubtless in the distant future a less cumbrous and changeable system of notation will be devised, but in the meantime we had best put up with the present, inconvenient though it be.

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SECTION F.—ZOOLOGY.

THE results of the late meeting at Buffalo of Section F, of the A. A. A. S., may be regarded as satisfactory. The average attendance at the sessions, which continued without interruption from Tuesday morning to Thursday evening, was thirty-five. Twelve of the one hundred and ten members elected at Buffalo chose this section. Twenty-five papers besides the address of Vice-President Gill were offered; two, however, were withdrawn—one to be given by the President of the Association as a public lecture and one to be read in Section E. The remaining twenty-three were read by their authors, with the exception of that of Mr. Miles, read by C. C. Nutting.

1. The first paper was by U. S. Entomologist L. O. Howard 'On the Entomological Results of the Exploration of the British West India Islands by the British Association for the Advancement of Science,' detailing the steps by which this important investigation had been brought about, and summarizing the results of the different papers which have been published since the beginning of the investigation. He eulogized the British Committee for its conception of the work and the liberality with which it has been carried on, showed the importance of the results so far achieved, and made a plea for the association of entomologists with scientific expeditions in this country, and for the close collecting of insects, which has apparently been heretofore considered as of less importance than the collection of higher animals and plants.

2. The second paper was by Mr. F. M. Webster, who discussed cases among insects where a species unarmed and in no way capable of protecting itself was, to a certain extent, protected by its resemblance to armed species, or such as are known to be distasteful. Others, by their actions, mimicked the movements of certain other species, and were thereby mistaken for such as are inedible. The ground was taken that birds, after learning that certain insects were not fit for food, would shun any other insects appearing like these, wherever they might come in contact with them, even though at a different season of the year. There may be cases where one species mimics another, when the enemy has become exterminated and no protection is needed. Caution was enjoined against hasty and immature conclusions, as there is much to be learned in the matter, but no facts should be cast aside as mere coincidences, when more facts would enable us to push the problem to a point nearer a solution. That insects, especially, gain protection from their coloration and movements is assured, but much caution is necessary before conclusions are reached. The paper was illustrated by specimens.

3. Prof. A. D. Hopkins, of Morgantown, W. Va., under the title 'On Life Zones in West Virginia,' gave in detail the work he had done in mapping these zones in his State as indicated by the insect fauna.

4. 'The Variations of certain Species of North American Odonata' was a paper

read by D. S. Kellicott giving the results of observations on the variations in size, appendages and coloration of *Enallagma carunculatum* Morse, *Gomphus fraternus* Say, and *G. externus* Selys. It was shown that the size of these odonates is remarkably constant in Ohio. That the male abdominal appendages are almost without variation, affording the most reliable generic and specific characters; and that many color markings commonly used in description are too inconstant to be relied upon independent of structural characters.

5. 'A Case of Excessive Parasitism' was then briefly described by L. O. Howard. He described in some detail the facts concerning the rearing of one hundred and twenty-seven specimens of six species and five genera of Chalcididæ from the *Lecanium* scales on a twig of arbor vitæ received from Ottawa, Canada.

6. 'Notes on the Occurrence of Dragonflies in Ohio in 1896' was a second paper by D. S. Kellicott which stated that *Odonata* have been unusually abundant in Ohio the present season, which was unexpected, inasmuch as the seasons of 1894 and 1895 were those of extreme drouth, causing the water to wholly disappear from ponds and streams over wide areas. It would appear to be a fair inference that the nymphs can sustain themselves in the mud or in cavities of the dry earth during periods of prolonged drouth. Many species appeared weeks, and in some cases months, before the usual date. This was thought to be due to continuous hot weather, beginning April 10th. At Columbus ten species were taken in April.

7. 'Scyllarus and Anemonia—A case of Semi-commensalism,' by Edward L. Rice, referred to a specimen of Scyllarus, confined in the same aquarium with Anemonia, was observed to lie habitually in the vicinity of the anemone, returning to the same when placed in a distant part of the tank among stones or algæ, furnishing ideal nooks for concealment. This case is of interest, in connection with the well-known extreme symbiosis of Pagurus and Adamsia, as showing that the Crustacean seeks the anemone, probably gaining protection from the nematocysts of the latter.

8. This ended the papers and discussions of the first day. The second, Wednesday, was begun promptly with a fair attendance; the first paper was by Prof. C. W. Hargitt, entitled 'Notes upon Cordylophora.' *Cordylophora* has long been known to be capable of existence under a wide range of conditions. In December, 1895, a colony of these hydroids, growing on a bit of slag in company with several specimens of acorn barnacles were brought to the writer in a pint of brackish water. They remained in a jar in the laboratory for several weeks and were twice frozen almost solid; they were then supposed to be dead and were set aside. After some time the water was partly poured off and replaced from the top and once more set aside when the barnacles were seen to be alive; then specimens of *Cypris* were put in the jar for food. Late in May there were no signs of life; the water was again poured off and replaced from the top. After several weeks it was noticed that there were several colonies of the hydroids feeding freely. The barnacles also were alive. Both forms had withstood freezing and confinement in a limited quantity of water which had been gradually changed from sea water to fresh water. The hydroids were still alive August 20th.

9. The first of the morphological papers was read by Mrs. Susanna P. Gage, on 'Modification of the Brain during Growth.' A brief abstract follows:

1. The greater bends of the brain tube are associated with early development of the eye and its nerve fibers, the post-commissure, the ventral commissure and the fifth nerve.

2. The pons-bend is increased by a fold of the membranous roof of the brain which coalesces and extends from the outside of the brain-tube to meson.

3. The thin walls of the cerebrum, the tela and plexuses, are really laterally continuous with the membranous roof of the diencephal.

4. The dorsal and ventral zones of His have not been identified in the forms studied—cat, turtle, bird and Amphibia; rather the indications are of a segmental arrangement of the parts of the brain with a secondary formation of sulci which probably have a wide morphological significance.

10. 'A Note on the Membranous Roof of the Prosencephal and Diencephal of Ganoids,' by B. F. Kingsbury, was an interesting discussion in the neurology of species of fishes named below. Principal stress was laid on the evaginations of membranous roof of the ganoid brain—the *paraphysis*, *dorsal sack* and *epiphysis*. He emphasized the presence of a paraphysis, occurrence and value of the 'dorsal sack' and the existence of a second epiphysial structure in the adult Amia and its innervation. The forms discussed were *Amia*, *Lepidosteus*, *Acipenser* and *Polyodon*.

11. The same author followed with 'The Structure and Morphology of the Oblongata of Fishes.' He discussed the regions which make up the dorsal portion of the oblongata in Ganoids and Teleosts: (1) The spinal, ascending Vth tract, (2) the homologue of the fasciculus communis of the Amphibian brain, (3) center for the auditory nerve and the nerves of the lateral line system. He referred also to the modifications of these regions in *Amia*, *Lepidosteus* and *Acipenser* and in representatives of thirteen families of Teleosts and the fusions that occur. Two results may be mentioned: the vagus nerve derives a small part of its fibers from the spinal V tract (in some). The *lobus vagi* and *lobus trigemini* are but differentiated parts of the same tract (*fasciculus communis*).

Mr. Kingbury's second paper concluded the work of the morning session of Wednesday. The afternoon sessions opened by two papers devoted to methods of science teaching in the secondary schools:

12. 'Differentiation of work in Zoology—in Secondary Schools,' by Wm. Orr, Jr., and

13. 'Field Work and its Utility,' by Jas. G. Needham.

Both papers were received with deep interest and were discussed at length. That the matter presented bids fair to receive due attention in the future is attested by the fact that a joint meeting of representatives of Sections G and F agreed that it is desirable at the next meeting of the Association to have arranged in advance a joint meeting of the Sections for the consideration of questions relating to teaching, etc. The plan was adopted by Section F.

14. The above papers and discussions were followed by an illustrated paper by Miss Agnes M. Claypole on 'Appendages of an Insect Embryo.'

The form used was identified as *Anurida maritima* Guerin, and was collected under stones on the beach at Woods Holl, Mass. It belongs to a wingless group of Insecta, the Collembola, and is the first form of the group as yet studied in microscopic sections.

The cleavage of the egg is complete, holoblastic, a character belonging to this group of insects only, all the others having central cleavage. The appearance of the appendages takes place very early, the antennæ being the first of the series; following the antennæ is a pair of very small appendages on the body segment, carrying what is well known to be the third brain segment. Behind these the mandibles, 1st maxillæ and 2d maxillæ appear successively, in turn followed again by the thoracic ap-

pendages. All of these organs increase in size excepting the small pair on the third segment which remains unchanged till the mouth parts and antennæ have assumed almost distinctive characters. Then these small ones begin to grow as a ridge down each side of the three pairs of mouth parts and finally form a wide plate-like appendage enclosing the mandibles and second maxillæ entirely. In the adult the mouth parts are known to be enclosed in a tube or to be 'drawn in' as the condition is usually described. If, as generally acknowledged, the insect antennæ are considered homologous with the first pair of antennæ of the Crustacean, a point of considerable interest is developed. The appendage of the third segment has been found in many insect embryos, but in all cases is a purely embryonic structure; it disappears before hatching. Among terrestrial Crustaceans, the wood lice for example, the second pair of antennæ is reduced to an extremely small size. Hence *Anurida* is an interesting form showing an insect in which the second pair of antennæ of the Crustaceans is present and functional in the adult; the function, however, is completely changed.

15. The first paper Thursday morning was a valuable one by Miss Isabella M. Green on 'The Peritoneal Epithelium in Amphibia.' The principal results of this investigation may be summed up as follows:

1. Cilia were present upon parts of the peritoneum of all the adult females studied.

2. Cilia were constant upon the following parts, hepatic ligament, the ventral wall of the body cavity, the membranes near the mouth of the oviduct and the serosa of the liver.

3. In *Necturus* some of the adult females showed cilia also upon the dorsal wall of the body cavity.

4. Specimens of *Amblystoma* taken both before and after ovulation and in August differed from the other species in having cilia upon the mesoarium and the membranes supporting the oviduct.

From the fact that the cilia are present in the adult female and that the direction of the current produced by them is toward and into the mouth of the oviduct, it seems, without doubt, that the physiological purpose of the cilia is to carry the ova to the oviducts.

16. 'The Heart of the Lungless Salamanders of Cayuga Lake,' by Grant S. Hopkins, followed in which it was shown that the current statement regarding the heart of the amphibia must be modified somewhat, for in the lungless salamanders the post cava (or sinus venosus) does not open into the right auricle any more directly than into the left. The auricles communicate with each other very freely. The writer had not been able to make out the presence of pulmonary veins opening into the left auricle, in the lungless forms. One additional lungless salamander was added to the list.

17. 'Observations on the Chameleon, *Anolis principalis*,' by Geo. V. Reichel. This paper treated of the American anolid with observations made by the author concerning its power to change color, its habits, and suggested the possible use of the chameleon as an exterminator of flies and other dwelling house insect-pests.

18. The afternoon session was opened by a paper by Manly Miles read in the absence of the author by C. C. Nutting. The title was 'The Relative Efficiency of Animals as Machines.' It was an inquiry as to the relative efficiency of different classes of animals in utilizing the potential energy of their food in useful work; approximate quantitative estimates were given of the expenditure of energy in making 100 lbs. of increase in fattening animals and the relative expenditure in repairs of the animal machine. A similar estimate was given of the utilization of energy in milk production.

19. 'Some Abnormal Chick Embryos,' was a paper by C. W. Hargitt, reviewing some of the more striking facts of teratology, of the time. Also noticing the remarkable advances and significance of modern embryology, and the apparent climax as shown in the striking experiments of Driesch, Roux, Wilson and others, shows the probably similar character of experiments of Dareste, Metrophanow, and others on the embryology of the chick.

The paper next dealt with special examples of abnormal chick embryos which have come under the writer's observations quite recently, several specimens of which were exhibited.

Various phases of irregularity were noted, such as imperfectly developed embryos; in some only the head-fold; in others hardly beyond the primitive groove; in some other embryos degeneration of the whole blastoderm, even after considerably advanced stages. Several cases of double and triple embryos were noted.

20. 'On a peculiar Fusion of the Gill-filaments in certain Lamellibranchs,' by Edward L. Rice.

In many folded types of lamellibranch gills the examination of serial sections perpendicular to the filaments shows a large number of filaments in the upper portion of the gill, which gradually meet and fuse to a relatively small number as the free margin is approached. Thus in *Cardium edule* a reduction of 23 filaments to 6 was noted.

The fusion is usually almost exclusively limited to a narrow band in the near vicinity of the free borders of the gill, where the folding of the lamellæ is necessarily much reduced. Another zone of fusion may be noted, in cases where the outer gill is produced to form a dorsal appendage, at the transition from the gill proper to the appendage. Here again the fusion is correlated with a reduction in the folding.

Is this phenomenon really a fusion or a branching of the original filaments? At the free border of the gill the filaments of one lamella go over without interruption into those of the other, and the number in the two lamellæ must in either case be equal. In the 'zone of fusion' the number becomes very unequal. Higher in the gill, where the maximum number is reached, the two lamellæ contain equal numbers of filaments, showing conclusively that the maximum is the original number.

This fusion was observed only in distinctively lamellar gills in which the folding is developed. It is most conspicuous in *Cardium*, *Batissa*, *Psammobia*, *Chama*, *Solenocurtus* and *Donax serra;* less developed in *Cyprina* (strong on the transition line of gill proper and appendage) and *Venus;* very slightly developed in *Solen*, *Mya*, and *Donax politus*. Though fusion was observed in *Cytherea*, *Donax trunculus*, *Ostrea*, and *Thracia*, nor in the *outer gill* of *Cardium* and *Psammobia*.

The fusion seems to have little systematic value, but to be mechanically correlated with the folding and the crushing due to the inelastic gill margin with an increasing number of filaments. The upper part of the gill of *Cardium*, if flattened, would measure some seven times the length of the free margin.

Apparently this fusion has not been noted in the literature, unless figures showing an unequal number of filaments in the two lamellæ, *within one fold*, point in this direction, *e. g.*, *Cardium* (van Haren), *Lima* (Pelseneer), *Donax trunculus* (Sluiter), *Ostrea* (Kellogg).

21. 'Experiments Upon Regeneration and Heteromorphosis,' by Chas. W. Hargitt. This paper reviewed a series of experiments carried on at the Marine Biological Station during the present summer upon regeneration among the Hydromedusae. The experiments of earlier investigators upon hydroids were repeated among various fam-

ilies and genera, and the most important results verified. The experiments upon medusæ were confined to the genus *Gonionemus*, members of which from physiological habit loaned themselves quite readily to such work. While the series of experiments have not been completed, enough has been done to establish the capacity of even such specialized forms to regenerate various parts and organs with great readiness, and that both centrifugally and centripetally. Indeed, an apparent capacity for considerable heteromorphism.

22. The President of the Association read the next paper on 'The Penial Structures of the Saurians,' which was printed in abstract in the last number of this JOURNAL.

23. 'The Relationships of the North American Fauna,' was then presented by the chairman of the section, Vice-President Gill, and discussed at length by Prof. E. D. Cope and others. In the course of his remarks the author said: "The question of the extent and relationship of the North American Fauna have been several times discussed recently and very different conclusions deduced. I do not feel inclined to recede from the position taken years ago. It depends upon the reliance which is placed upon a special group whether we are lead to one view or another; for example, if we take the birds alone we may acknowledge the bonds that bind temperate northern America and Eurasia; if we take the lizards, the North American Group is simply an extension of the Southern; if we take the mammals, the reality of an Arctic region may be insisted on. But the acceptance of an Arctic region by no means clears away the difficulties; it rather doubles them, for we have then the task of defining the boundaries between that Arctic region and the North American, on the one hand, and the Eurasiatic, on the other. It seems best then to consider the Arctic lands as neutral territory and to correlate zoogeographical and geographical data, recognizing the regions admitted by Sclater, Wallace and most other zoogeographers. The most significant evidence in favor of the distinction of the North American and Eurasiatic faunas is furnished by the fishes. Certainly the ichthyologist cannot subscribe to the union of the two into a single Holarctic region."

The Vice-Presidential address, 'On some Points in Nomenclature,' was read Monday p. m. and appears in full in the present number of this JOURNAL.

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Secretary.

STATE UNIVERSITY, COLUMBUS, O.

THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION.

MEETING in a great commerical center like Liverpool, and in a city which is the seat of a young but vigorous geographical society, it was to be expected that the Geographical Section of the British Association should be neither less active nor less popular than in former years. It may, perhaps, be the case that the large audiences, on several occasions approaching a thousand, were attracted by an unwontedly liberal use of the lantern for illustration, but no single slide was shown which was not either exhibited for the first time, or was not in a very special manner calculated to fix the impression produced by the papers. The Section met on five days, in the course of which 34 communications were made, almost all of them longer than the average of papers read in other sections. Limitation of discussion was therefore inevitable, and several points which might have led to lively debates had to be passed by in silence. There was no lack of variety in the program; indeed, the difficulty was to secure any sort of logical order in the nature of the papers read on a given day. The provisional program which provided for some such order had to be abandoned

on account of the changed plans of authors and the return of so many Arctic expeditions within the month prior to the meeting of the Association. The following brief resumé will serve to indicate the variety and richness of the fare offered in Section E; the papers themselves will in most cases be published in one or other of the British geographical journals.

The President was Major Darwin, one of the Honorary Secretaries of the Royal Geographical Society and son of the great naturalist. Amongst the Vice-Presidents were Sir Erasmus Ommaney, Sir Lambert Playfair, Dr. P. L. Sclater, Mr. John Coles and Mr. E. G. Ravenstein; while Colonel Bailey, Commander Phillips, Mr. H. M. Dickson and Dr. H. R. Mill acted as Secretaries.

Major Darwin's address opened the meeting of the Section, on Thursday, 19th September. He dwelt mainly on the geographical problems involved in the opening up of the interior of tropical Africa to external trade. He was led to consider that parts of tropical Africa in which the average density of population was less than 8 per square mile were unlikely to be of commercial value, and therefore he limited the problem to the study of the best means of communication between regions of higher density of population and the sea. This is practically a question of conjoint systems of waterway and railway, and special attention was given to the various short lines already at work in tropical Africa, and to the larger schemes for longer railways which are now being discussed and commenced. Major Darwin concluded: "All I have attempted to do is briefly to sketch out some of the main geographical problems connected with the opening of central Africa in the immediate future. Such a review is necessarily imperfect, but its very imperfections illustrate the need of more accurate geographical information as to many of the districts in question. Many blunders may have been made by me in consequence of our inaccurate knowledge, and, from the same cause, many blunders will certainly be made in future by those who have to lay out these routes into the interior. In fact my desire has been to prove that, notwithstanding the vast strides that geography has made in past years in Africa, there is yet an immense amount of valuable work ready for anyone who will undertake it.

"Possibly, in considering this subject, I have been tempted to deviate from the strictly geographical aspect of the case. Where geography begins and where it ends is a question which has been the subject of much dispute. Whether geography should be classed as a separate science or not has been much debated. No doubt it is right to classify scientific work as far as possible; but it is a fatal mistake to attach too much importance to any such classification. Geography is now going through a somewhat critical period in its development, in consequence of the solution of nearly all the great geographical problems that used to stir the imagination of nations; and for this reason such discussions are now specially to the fore. My own humble advice to geographers would be to spend less time in considering what geography is and what it is not; to attack every useful and interesting problem that presents itself for solution; to take every help we can get from every quarter in arriving at our conclusions; and to let the name that our work goes by take care of itself."

Mr. H. S. Cowper followed with a short account of a journey made by him in northern Tripoli, in March 1896, in the course of which he had photographed a number of remarkable megalithic structures, some of them never previously described. The Rev. J. C. Robinson gave an illustrated lecture on the Housa people of the Niger district.

In the afternoon Mr. John Coles exhib-

ited two forms of camera for photographic surveying, and explained the principles of the process, expressing his belief that photography was destined to play a very large part in future surveys, especially for rapidly constructing small scale maps of large areas. Mr. H. N. Dickson spoke on his work now in progress on the oceanography of the North Atlantic; and Dr. H. R. Mill brought forward the scheme for the geographical description of the British Isles which has already been noticed in SCIENCE. He stated that the Royal Geographical Society had authorized the compilation of a descriptive memoir of a specimen sheet.

On Friday the proceedings commenced by a paper on old tapestry maps of some English counties contributed by the Rev. W. K. R. Bedford. These maps were woven about the end of the sixteenth century and present many interesting features. Dr. Tempest Anderson described the Altels avalanche of September, 1895, showing a series of slides. Lieutenant Vandeleur gave a careful and valuable description of the remoter parts of Uganda and the country bordering the Upper Nile, where he has recently traveled extensively in the course of his military duties. Dr. F. P. Gulliver, of Harvard, was welcomed as a disciple of the American school of physical geography, and by the aid of a series of lantern-diagrams he gave an interesting account of the coast forms of Dungeness and Romney marsh with deductions as to their origin. In the afternoon Mr. A. Montefiore Brice, Secretary of the Jackson-Harmsworth expedition, gave a full account of the work carried out by Mr. Jackson in Franz Josef Land, which he is determined to thoroughly survey and where he is now spending his third consecutive winter. Slides were shown of the scenery of Franz Josef Land, and of Dr. Nansen and his companion Johansen while the guests of Mr. Jackson.

Mr. Brice announced that Mr. Harmsworth would probably send out two ships next year to attempt to push northward into the sea beyond Franz Josef Land. M. G. F. Scott Elliot discoursed on the influence of climate and vegetation on African civilization, endeavoring to classify and characterize the tribes according to their environment. Mr. Vaughan Cornish completed the day's work by an original memoir of great merit on the character and origin of sand-dunes. He showed the parts played respectively by the wind drifting sand and driving it in showers, by the eddy in the lee of the dune in gouging out the leeward face, and by gravity in reducing to the angle of repose any steeper slopes temporarily produced by wind. He also recognizes negative dunes, hollowed out in sand, which rests on a hard floor, and he draws attention to the homology between sand-dunes formed in the air and sand-banks formed in the water.

On Saturday Mr. A. J. Herbertson showed some monthly rainfall maps of the world, which he is compiling for Bartholomew's great English physical atlas based on Berghaus. The Report of the Committee on African Climatology was read, and Sir James Grant gave a discourse on Canada with special reference to the discoveries of gold in the Dominion.

On Monday several papers of special interest were read. Mr. W. A. L. Fletcher began with a description of the great journey across Tibet from north to south, on which he accompanied Mr. and Mrs. St. George Littledale to the neighborhood of Lhasa. Mr. F. W. Howell and Dr. K. Grossman gave papers on the scenery of the less known parts of Iceland, very finely illustrated by slides of glacial and volcanic land-forms. Mr. G. G. Chisholm read a philosophic paper on the relativity of geographical advantages, in which he showed that at different periods of history, the con-

ditions of physical, economic or political environment which contribute to the prosperity of a place are not necessarily the same. This thesis he supported by a number of striking examples. Mr. Ralph Richardson made some remarks on the various so-called 'Schomburgk lines' which appear on the maps of British Guiana. In the afternoon Sir Martin Conway, who had returned from an expedition to Spitzbergen a few days previously, gave a preliminary account of the first crossing of the south-western island, and drew a graphic picture of the extraordinary difficulties he had to overcome on account of the slushy nature of the snow and the marshes which covered the valley floors. His companions Dr. J. W. Gregory and Messrs. Garwood and Trevor-Battye had made most important geological, zoological and botanical observations and collections. Mr. H. W. Cave described, with numerous fine photographs, the ruined cities of Ceylon, and Prof. J. Milne gave a paper on earthquakes and sea waves with special reference to recent occurrences in Japan.

The Section met for the last time on Tuesday, September 22d, when, after a paper by Mr. A. E. Fitzgerald (who is about to attempt the ascent of Aconcagua), on his passage of the Southern Alps of New Zealand, General Sir Charles Wilson gave a masterly address on the Egyptian Sudan. He confined himself, of course, to the non-political conditions of the country, and laid stress on the importance of a railway being constructed between the Red Sea and the Nile above the cataracts. The country he looked upon as one with a great future for trade when once a way to the coast has been provided. Mr. A. W. Andrews read a paper on the teaching of geography as the basis of history in schools. From practical experience he stated what could be done if the teacher threw his heart into the work. Mr. E. Odlum, of Vancouver, gave a short description of the border-lands of British Columbia and Alaska, which acquired a special interest from the presence, on the platform, of the first settler in British Columbia, Mr. John Coles, and the surveyor of the southern boundry line of the province, Sir Charles Wilson. In the afternoon Mr. J. Scott Keltie, who had just returned from Christiania, described the triumphal reception of Dr. Nansen and the crew of the *Fram* in the Norwegian capital, and also gave a brief outline of the course of the expedition, citing Prof. Mohn's high tribute to the unique value of the observations made in the course of it. He pointed out that although Nansen had returned in the *Windward* he had anticipated no greater difficulty in crossing to Spitzbergen than in reaching Franz Josef Land itself. Mr. A. J. Herbertson showed a simple piece of apparatus for illustrating map-projections by means of the shadow cast by a wire hemisphere. Mr. B. V. Darbishire showed a new population-map of South Wales, on which all inhabited houses as well as villages and towns were marked. The proceedings were brought to a close by the reading of an interim report of the Committee on the Teaching of Geography in Schools, and the Section was adjourned until Thursday, 19th August, 1897, in Toronto.

It may be mentioned here that it would be a matter of importance if intimation of any papers on geographical subjects to be offered to the Section next year would be made as early as possible to me at 1 Savile Row, London, W., so that as representative a program as possible may be prepared before the meeting. The meeting is looked forward to as one at which it will be possible for Section E of the British Association to learn much as to the recent advances in geography on the American continent.

HUGH ROBERT MILL.

CHEMISTRY AT THE BRITISH ASSOCIATION.

The address of Dr. Ludwig Mond, President of the Chemical Section at the Liverpool meeting of the British Association, was on the History of the Manufacture of Chlorin. After sketching the earlier methods, Dr. Mond treated very fully the Weldon and the Deacon processes, and then gave the details of his own work on the recovery of the chlorin in the Solvay process of soda-manufacture. In outline, Mond's process is as follows: The ammonium chlorid, obtained in a very pure condition by crystallization from the refrigerated liquors of the Solvay process, is passed as a vapor over hot pills of a mixture of magnesia, potassium chlorid and china clay. Ammonia is given off and condensed, while the chlorin unites with the magnesia. The pills are then heated more strongly and hot air passed over them; the magnesia is regenerated and the chlorin given off, to be absorbed by lime for bleaching powder. By this method, which has been in commercial operation for several years at Winnington, the Solvay process is able to compete with the LeBlanc process in the manufacture not only of soda, but of bleaching powder. In conclusion Dr. Mond referred to promising developments along the line of the manufacture of chlorin by electrolysis.

The paper which attracted the most attention in the Chemical Section was that of Prof. Ramsay on Helium. It was mainly devoted to his diffusion experiments, already described in this Journal. He said he was about to carry out experiments on oxygen and nitrogen, in order to determine if they can be resolved by the diffusion process into constituents of slightly different density. In the course of the discussion which followed the paper, Dr. Mond spoke of argon and helium as being a kind of matter different from the ordinary chemical elements, and having no chemical affinities and characteristics. He did not consider it improbable that there might be a whole series of substances not belonging to chemistry, whose existence seemed not only to upset the fundamental law of chemistry, Dalton's Law, but also to cast doubt on the present fundamental notions regarding physical science.

It may be noted that the idea that all the atoms of an element may not have the same weight is not a new one first broached in the case of helium, but it was some years ago suggested by Prof. Crookes in connection with his work on rare earths.

Prof. Dewar read a paper on Low Temperature Research, urging especially the necessity of physical investigation. He described a very accurate method of making specific gravity determinations in liquid oxygen.

Dr. F. Hurter discussed the manufacture of chlorin by means of nitric acid, and said that in spite of its theoretical advantages it had not proved a commercial success, nor did it give promise for the future.

Prof. Liebreich, of Berlin, repeated a series of experiments before the Section with a view to proving the diminution of chemical action resulting from the limitations of space. He advanced the general propositions that liquids, in proportion as they are placed in confined spaces, acquire by equilibric reactions the properties of solids; and that friction in such fluids has a bearing of considerable importance on chemical reaction.

Dr. William Newton, of London, described very fully the nitrate deposits of Chili, and deprecated very strongly the present crude and wasteful methods of mining and working up the products.

One of the most interesting papers was by Sir Henry Roscoe on Chemical Education in England and Germany. England is feeling very keenly the fact that Germany is along most lines monopolizing the chemical industry of the world. While larger

government endowments for technical education (at present about $3,500,000 a year), especially for research, are desirable, the author of the paper, as well as those who discussed it, agreed that the greatest need is the improvement of the system of secondary education. J. L. H.

RELATIONS OF THE LEMURS, PRIMATES AND UNGULATES.

PROF. A. A. W. HUBRECHT has contributed to the second volume of the Gegenbaur *Festschrift* an important memoir upon the placentation of *Tarsius*, in which he reaches the conclusion that this animal should be entirely removed from the Lemuroidea, where it has always stood hitherto, and placed with the true Primates or Anthropoidea. The following is a recapitulation of his conclusions:

1. Numerous peculiarities in the formation of the blastocyst of *Tarsius spectrum* show it to be more closely related to monkeys and man than to any other mammalian genus.

2. The ventral stalk in the blastocyst of man and monkeys, with the ontogenesis of which we were up to now most imperfectly acquainted, is explained both onto- and phylogenetically by the facts which we observe in *Tarsius*.

3. By its dentition *Tarsius* takes an intermediate place between the monkeys and mesozoic Insectivora; the upper molars are purely tritubercular, the lower ones tuberculo-sectorial with well-developed pr^d, me^d, pa^d, hy^d and en^d.

4. Among fossil Mammals the genus *Anaptomorphus* Cope takes up an intermediate position between *Tarsius* and man. Cope was thereby actuated to choose the specific name *homunculus*.

5. The Mammalian order of the Primates should henceforth be looked upon as fully distinct from that of the Lemures; the former reaches back into the Mesozoic Period and has been independent of all the other Mammalian orders through the whole Tertiaries.

6. To the order of Primates belong (1) man, (2) the monkeys, (3) the two genera *Tarsius* (recent) and *Anaptomorphus* (fossil, lower Eocene), which have been hitherto classified with the Lemures.

7. Undoubtedly a greater number of fossil genera will have to be classed with the Primates; great prudence should, however, prevail before we assign that place to any of them. It is better to wait for more complete skeletons before we attempt to establish any sharp distinction between fossil Primates and Lemures.

8. The Lemures (inclusive of Cope's extinct Mesodonta) have in their turn close relationships to numerous Primitive Tertiary mammalian types, such as the unspecialized Ungulata, Condylarthra, Creodonts, etc. The placentation and the blastocyst are in the Lemures fundamentally different from those of *Tarsius*, but are at the same time undoubtedly phylogenetically comparable to those of the latter mammals.

9. The placentation and the formation of the blastocyst in the Primates cannot be derived from what we find in the Lemures. They can, however, without difficulty be brought into genetic relationship with processes such as we notice in central Insectivorous genera, such as *Erinaceus*.

CURRENT NOTES ON PHYSIOGRAPHY.

GRAPE BELT OF WESTERN NEW YORK.

GRAPE raising is an important industry along the Erie shore of western New York, and it appears that. in addition to the favoring climatic influences of the lake, the gravelly bars of the ancient expanded lake offer the best soils for vineyards, as described by Tarr (Bull. 109, Cornell Univ. Agr. Exp. Station). These ancient lake shores lie on the Erie plain, an inner lowland denuded on the weak lower Devonian

strata, between the rising upper Devonian inface that ascends to the Alleghany plateau, on the south, and the falling Niagara inface that descends, on the north, to the Ontario plain, the latter being another inner lowland of the very ancient coastal plain of which the Laurentian highlands of Canada are the oldland.* A large part of these inner lowlands is under the water of the lakes, but where emerged they support a thriving agricultural population; fruit being extensively cultivated on the Ontario plain north of the Niagara infacing escarpment (locally known as 'the mountain'; a good illustration of the geographical poverty of our language), as well as on the Erie plain. Although the ancient lake shores hereabouts are characterized by gravel bars, the present Erie shore is mostly a cliff, cut in shales. Besides the reasons suggested by Tarr for this contrast, the greater time of action at the present level may be considered. The ancient shore lines of Lake Erie in the fruit belt did not advance beyond the youthful stage of building off-shore bars on a shallow bottom. The present shore lines have advanced to the mature stage of low cliffs cut into the gently sloping mainland. Whether the present shore lines went through the preparatory phase of building off-shore bars cannot be said without further study, but there does not appear to be any reason why they should not have witnessed all the normal stages of shore-line development up to their existing maturity.

THE GORGE OF THE AAR.

A. R. Wallace, an earnest advocate of the glacial origin of lake basins, illustrates the competence of ice streams to erode rock basins by the relation of the gorge of the Aar, cut through a rocky barrier that traverses its valley above Lake Brienz, to the broad valley-basin further upstream (*Fortnightly Review*, Aug., '96). The basin is covered with a plain of alluvium, estimated to be 200 feet deep. The rocky barrier averages 450 feet higher than the alluvial plain, and is thought to have lost 350 feet of height by glacial erosion. The rock floor of the basin is thus shown to be 1000 feet deeper than the preglacial height of the barrier, and this depth is taken as the measure of glacial erosion above the barrier.

The extension of valid argument of this kind to the conclusion that all lakes in glaciated regions are of glacial origin, seems illogical; and the derogatory references to the explanation of lakes by subsidence or deformation seems hardly candid in face of the facts reported by many Swiss geologists. Indeed, the generality of glacial erosion in certain regions may be so forcibly met by the generality of glacial deposition in others, that lakes must be individually studied if their actual origin is to be explained. The citation of the essays by Lincoln and Tarr concerning the Finger Lakes of New York, and the silence concerning such essays as Aeppli's on Lake Zurich, give Wallace's essay an air of special pleading.

ALAÏ AND PAMIR.

F. de Rocca summarizes recent explorations of the elevated portion of central Asia, in which he has himself taken part (Rev. de Géogr., xix., 1896, Jan., April). The Pamir is described as an immense uplift, trenched by profound valleys, and surrounded by colossal mountain ranges; thus differing from the definition given by Curzon (Science, Aug. 21, 1896). The mountains are characterized as colossal, grandiose, imposing; but relation of form to structure and denudation is hardly touched. The long valleys descend gradually eastward to the interior basin, but abruptly westward to the open lowlands. The main divides are sometimes on the valley floors.

*Oldland, inner lowland and inface are convenient terms in the description of denuded coastal plains.

The name, Alaï, is applied to an extensive intermontane plain, and to the range enclosing it on the north. This plain and the similar elevated intermontane plains of the Pamir further south are spoken of as 'plateaus,' without explicit indication of structure, whether rock-floored or built of waste from the adjoining mountains, but the latter origin is implied. Lakes are said to be numerous, but they are briefly mentioned without sufficient indication of their associated features.

In a word, this series of articles forms a good example of the style of geographic de scriptions in vogue to-day. It furnishes much general information as to the conditions of a region that has in recent years attained more political importance than its intrinsic value would give it; but the physiographic basis of the information is most elementary where it it is not vague or wanting.

NOTES.

THOSE who attend the Geological Congress at St. Petersburg next summer will find an instructive summary of the movements of the earth's crust in Russia by Karpinsky (Ann. de Géogr., v., 1896, 179–193). It is pointed out that the most tranquil area lies on the northwest, and that troughs of depression elsewhere show a notable sympathy in direction either with the Ural or the Caucasus mountains.

THE fertile subject of the physical subdivisions of the Alps is discussed anew by Haug (*Ibid.*, 167–178). He emphasizes the importance of synclinal basins, such as that of the Dolomites, as well as of anticlinal central *massifs*. An instructive map accompanies the essay.

FAIRCHILD describes several kame areas of pronounced form in western New York (Chicago Journ. Geol., iv., 1896, 129–159) and a number of temporary glacial lakes and their southward overflow channels in the region of the Genesee valley (Bull. Geol. Soc. Amer., vii., 1896, 423–452).

W. M. DAVIS.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

RUINS IN SOUTH AFRICA.

AN instructive article by Mr. R. M. W. Swan, in the Journal of the Anthropological Institute for August, gives further information about the ruined cities in the Zambesi country. They exist in great numbers throughout that territory, and are usually of small dimensions. The principal edifice is of rough stone, and is carefully oriented to the quarters of the heavens. For this reason it is probable that they served some religious propose, and some of them were 'symbols of reverence erected by solar and phallic worshippers.'

They can no longer be attributed to the Phenicians. "Both in their plans and masonry, they are quite unlike anything that we know of that is Phenician." All the evidence indicates that their builders came for gold, and many specimens of that metal have been found in the ruins. A number of the sites are, however, in regions which are not auriferous. This Mr. Swan explains by the supposition that the attraction was the search for gems, which are found in moderate abundance. He does not attempt to identify the builders, but inclines to the belief that they will be shown to have come from southern Arabia.

ANTIQUITIES OF COSTA RICA.

THE National Museum of Costa Rica has commenced the publication of a series of articles descriptive of the antiquities of that republic. The first number (pp. 37) is by Señor Anastasio Alfaro, the competent director. It is illustrated and divided into three chapters, the first general, the second on the gold work of the Guetares Indians, the third on arms and ornaments in stone.

The Guetares were a tribe of moderately high culture in the interior. One of their cemeteries was excavated by Mr. Alfaro, and a large amount of material obtained. They were skilful in dressing stone, and one of their tables (or seats?) pictured in the report is remarkable for symmetry and finish. It is forty centimeters high and seventy-one in diameter. As goldsmiths they were not equal to the tribes near the Chiriqui lagoon, and decidedly inferior to those of Colombia, the Chibchas and Quimbayas. Their pottery, a number of specimens of which are figured, was superior in design and technique. It was of curious forms, and often ornamented with figures in polychrome.

The affiliations of the Guetares are still uncertain, as, except a few proper names, we have no specimen of their language, and they are apparently extinct.

D. G. Brinton.

University of Pennsylvania.

ASTRONOMICAL NOTES.

The Astronomical Journal of October 6th contains the announcement by Dr. See of his re-discovery of the companion of Sirius at the Lowell observatory. The other astronomers of the observatory have also seen and measured the companion. Dr. See says that, according to these measures, the companion has fallen no less than 30 degrees behind its predicted place in position angle. We suspect that this statement may be due to a misprint or a slip of the pen.

We have received Vol. IV. of the publications of the Kuffner observatory in Vienna. It contains zone observations between 6° and 10° south declination, together with mean positions derived from them. There are also descriptions, by Messrs. Repsold, of the new prime vertical instrument of the observatory, which is provided with a vertical circle, and of the new heliometer. Dr. S. Oppenheim contributes to the volume a paper on special periodic solutions in the problem of three bodies, and Dr. de Ball has an investigation of the orbit of Comet 1882 III.

H. J.

SCIENTIFIC NOTES AND NEWS.

A scientific session of the National Academy of Sciences will be held in New York, at Columbia University, beginning November 17th, 1896, at 11 o'clock a. m. Members who have papers for this meeting may send the titles to Dr. C. F. Chandler, Columbia University, New York City. A special stated session of the Academy is called for Wednesday, November 18th, in New York, to consider the President's Annual Report to Congress, and other business that may come before the Academy.

The Honolulu correspondent of the United Associated Presses writes that Mr. C. R. Bishop has authorized the trustees of the Bishop Museum to expend $750,000 in building an aquarium and marine biological station at Honolulu, for the scientific study of marine life in the Pacific. Prof. W. T. Brigham has just returned from visiting European aquariums and is prepared to complete the plans. A body of professors and investigators will be maintained, and students will doubtless be attracted from Europe and America.

Major J. W. Powell and Mr. Frank Hamilton Cushing have recently completed a season's archæologic work on the coast of Maine. A number of interesting shell mounds were explored, and their contents are now *en route* to Washington for installation in the National Museum. In addition to the artifacts exhumed from the shell mounds, the collectors were able to obtain, through the aid of the Passamaquoddy or Abenaki Indians, an aboriginal birch-bark lodge, constructed by the natives in primitive fashion, native implements being chiefly employed in its construction.

Dr. Albert S. Gatschet, also of the Bureau of American Ethnology, has recently returned from an ethnologic trip through eastern Maine and contiguous parts of British territory. His scientific results include a rich collection of

linguistic material obtained among the Passamaquoddy Indians.

THE United States Coast and Geodetic Survey has completed the measurement of the base line known as the trans-continental arc lying along the 39th parallel of north latitude and extending from a point on the Atlantic coast ten miles south of Little Egg Island lighthouse, below Cape May, to six miles north of Punta Arenas lighthouse, on the Pacific, several miles above San Francisco. The base line is much the longest hitherto surveyed, and has cost the government about $1,000,000.

MR. J. E. SPURR, of the U. S. Geological Survey, who, with Mr. H. B. Goodrich and Mr. F. C. Schrader, went to Alaska, in May last, to study the geology of the gold deposits of the Upper Yukon region, reports the completion of his work and his arrival in San Francisco. The party spent the entire summer in the field. They reached the Upper Yukon in the middle of June and passed down that river to its mouth, stopping at the various mining settlements on the way. Mr. Spurr satisfied himself that the prospects for profitable quartz mining in the region examined are very good. There is a great ledge running northeast and southwest through the country, similar to the Mother lode in California. Mr. Spurr's report on the Yukon country, and that of Dr. Becker on the good prospects of the region lying along the Pacific coast, may both be looked for during the coming winter or spring, and will, doubtless, together constitute an important contribution to the knowledge of the gold resources of Alaska.

OF his recent extended study of the gold resources of the Transvaal region of South Africa, Dr. Becker says that the Transvaal Republic contains the largest gold deposits in the world. Within fifteen miles of Johannesburg, on what is called the main reef series, there is an amount of gold, practically in sight, estimated to be worth $3,500,000,000, or nearly as much as the entire volume of gold coin now in the world. The gold is extraordinarily uniform, as uniform as coal in an ordinary deposit, as shown by shafts which have been sunk to a depth of 1,800 feet, and diamond drillings which have gone much further. At present the gold is being taken out at the rate of $100,000,000 a year. But the most surprising news which Dr. Becker brings is the testimony of an American, who was formerly his assistant in the Geological Survey, and who is now engaged in mining in the Transvaal, where he has made several millions of dollars. This American mining expert says that, to the best of his knowledge and belief, the gold deposit, instead of being thirty miles long—the region now in sight—is practically 1,200 miles long, except that in the rest of the region later deposits, have come in over the gold. This, however, will not prevent economical mining, but will simply delay it.

THE *Lancet* states that Prof. Liversidge, professor of chemistry in Sydney University, has made an exhaustive series of experiments, finding evidence in favor of gold being present in sea-water of the New South Wales coast in the proportion of ½ to 1 grain per ton, which in round numbers would make 230 to 260 tons per cubic mile. Our contemporary thinks the discovery deserves recording in its columns, "since recently the value of gold salts in therapeutics has been recognized, and it cannot be doubted that the cheapening of gold would lead to their application being extended in this direction." It seems, however, probable that the value of salts of gold in medicine as compared with those of other metals is largely psychological and would not increase with its cheapening.

IT has been found that the weather at Flagstaff, Ariz., is not satisfactory for astronomical observations during the winter, and Mr. Lowell will this month or next remove his observatory to a hill about three miles north of the City of Mexico.

THE International Congress of Hydrology, Climatology and Geology met on September 28th at Clermont-Ferrand. Dr. de Ranse, president of the committee of organization, made a speech and was subsequently elected president of the Congress. The three foreign vice-presidents are Prof. Ludwig, Prof. Kubern and Dr. Rotch, of the Blue Hill Observatory. The Congress meets in three sections, Hydrology, Climatology and Geology, for each of which there is a French and foreign honorary president.

We regret to record the following deaths: Gustav Kieseritski, professor of mathematics at the Polytechnic Institute in Riga, aged 67 years; C. J. Boone, professor of geometry and higher elocution at Georgetown College, D. C., at the age of 30 years, and Dr. J. P. E. Liesgang, the writer on photography.

A committee has been formed in London to arrange an international memorial commemorating the connection of Mr. Cyrus Field, Sir John Pender and Sir James Anderson with submarine telegraphy.

The Botanical Museum in Berlin, says *Die Natur*, will be enlarged by leasing seven rooms in a neighboring building. There is no longer room in the museum for research work, as the collections have recently grown rapidly and the exhibits from the recent industrial exposition have now been added.

We learn from *Nature* that the newly formed Society of Sicilian Naturalists will publish a journal of natural history entitled *Il Naturalista Siciliana*. The first number contains articles in Italian and in French on entomology, malacology, botany and crustaceæ. The Society, of which Prof. E. Ragusa is president, proposes to meet monthly in Palermo, and once a year in some other city of Sicily.

The Progressive American is the title of a new monthly journal devoted to the progress of science and invention, published by Hern & Co., New York, and edited by Mr. G. H. Hern. The first issue is largely made up of short items, some new and some old, some good and some bad. All signs of interest in science are encouraging and, though the ground of the new journal seems to be amply covered by *The Scientific American*, we hope that *The Progressive American* will make a place for itself and fill it with credit.

There have just been issued two works doing great credit to science in America. One of these is *An American Text-book of Physiology*, published by W .B. Saunders, Philadelphia. It is edited by Prof. W. H. Howell, who had the cooperation of the leading American physiologists. The other is the first volume of a *System of Diseases of the Eye*, published by the J. B. Lippincott Co., Philadelphia; and edited by Prof. W. F. Norris and Dr. C. A. Oliver. We hope to give adequate reviews of these works, but in the meanwhile it is pleasant to call attention to such admirable results of scientific collaboration.

A committee, with the Prince of Oldenburg as honorary president, has been formed to collect subscriptions for a monument to Pasteur in Russia.

The Croonian Lectures before the Royal College of Physicians of London will be delivered in 1897 by Dr. Hale White. Dr. Sidney Martin will give the course in 1898.

There has been published at Paris, in commemoration of the 100th anniversary of the faculty of medicine, a work giving the history of the school. It is written by Dr. A. Corlien with the cooperation of a committee, and entitled *Le Centénaire de la Faculté de Médecine de Paris* (1794–1894).

The general treasurer of the British Association, Prof. Rücker, has reported that the treasurer's receipts for last year were £3,773 2s. 3d. The payments included: expenses of Ipswich meeting, £148 10s. 5d.; rent and office expenses, £50 5s. 2d.; salaries, £505; printing, binding, etc., £1,007 5s. 4d.; payment of grants made at Ipswich, £1,104 6s. 1d. The investment account had remained unaltered, and stood thus on June 30, 1896: Consols, £7,537; India Three per cents., £3,600.

We learn from *La Vie Scientifique* that M. Etienne will shortly present in the French Chamber a bill introducing the decimal subdivision of time. The subject seems to be considered seriously in France, as a maker of watches has patented a double-faced watch, giving on one side the present sub-divisions and on the other the proposed decimal system.

The *Auk* states that Mr. James M. Southwick, well known as a commercial naturalist, has recently been appointed curator of the Museum of Natural History, lately established by the authorities of the city of Providence, R. I., in Roger Williams Park. A building has been erected at a cost of $40,000, a portion of which will be devoted to museum purposes, as required. Mr. Southwick will devote special efforts to securing representative collections of

the local fauna, and later to the formation of small loan collections which can be used by teachers in their class rooms.

ACCORDING to *Cosmos*, a new alpine meteorological observatory will be established on the summit of the *Rochers de Naye*. The arrangements are now being made by MM. Ruffy and Hagenbach Bischoff, of Bâle, members of the Swiss Meteorological Commission.

THE Middletown Scientific Association held a meeting on October 13th, at which suitable notice was taken of the death of G. Brown Goode, the founder of the Association.

AS announced some time since, Miss Helen Kellar, who, blind, deaf, dumb, has now reached the age of sixteen years, has been removed from a school for the deaf and dumb, and has been placed in Mr. Gilman's Cambridge School for Girls. It is not correct, as stated, in many of the daily papers, that she has entered Radcliffe College or passed the examinations for this, but in a private examination she showed herself competent to answer the questions of examination papers in English, French, German and history.

AT the Church Congress (Church of England) which met at Shrewsbury, on October 6th, a session was set apart for the discussion of the bearing of the theory of evolution on Christian doctrine. The Bishop of Litchfield presided, and addresses were made by Archdeacon Wilson, Prof. Bonney and Canon Gore. There seems to have been complete unanimity. Canon Gore said, 'Evolution had taken hold of theology; it had modified our way of thinking about it.' Archdeacon Wilson said, "Christian doctrine could adopt the evolutionary view of creation," that the theory of evolution had taught us to properly interpret "what was related as 'The Fall' *sub specie historiæ*."

WE have already called attention to the formation of the New York State Science Teachers' Association, whose object is the promotion of science teaching and the mutual acquaintance of those interested. A provisional committee has been appointed to conduct the affairs of the Association until the first annual meeting, which will probably be held during the Christmas holidays in connection with the State Principals' Association at Syracuse. All those interested in the teaching and promotion of science should join the Association and make efforts to attend its first meeting. The officers are: Simon H. Gage, President; Chas. W. Hargitt, Vice-President; Franklin W. Barrows, Secretary and Treasurer (45 Park St., Buffalo, N. Y.).

THE Chicago Institute of Education has appointed a committee of sixty whose duty it shall be to develop some feasible plan for carrying on systematic outdoor, or field work, in connection with nature study. The committee held its first meeting on September 19th, and a permanent organization was effected by the election of Mr. Wilbur S. Jackman as President and Mrs. M. L. T. Baker as Secretary, and the appointment of a number of sub-committees. One of the first works of the committee will be the preparation of maps of the evirons of Chicago, which will assist the pupils and teachers of the public schools in a systematic study of the country which lies within a convenient radius of the city. Syllabi will also be compiled giving information for reaching the different points of interest and for study.

UNIVERSITY AND EDUCATIONAL NEWS.

ACCORDING to the Boston *Transcript* the registration at Harvard University is about 3,590, of which number 1,260 are new names. There is a slight decrease in the college, but an increase of about 10 per cent. in the scientific school. There is also an increase in the graduate and medical schools. In the latter 50 per cent. of the students hold college degrees, as compared with 35 per cent. last year.

MR. GEORGE M. WARD has been elected President of Rollin's College, Winter Park, Fla.

DR. R. MEADE BOLTON, now bacteriologist of the Philadelphia Board of Health, has been elected instructor in bacteriology in the University of Missouri.

IT is reported that the University of Edinburgh has conferred the degree of M. A. on two women graduates, Miss MacGregor and Miss Geddes.

AT the University of Cambridge Mr. W. T. N. Spivey, of Trinity College, has been appointed to succeed Dr. A. Scott as demonstrator to the Jacksonian professorship of organic chemistry.

The lectureship in chemical physiology is vacant by the resignation of Dr. A. Sheridan Lea, F. R. S., on account of ill health.

Prof. Bubnof, of Dorpat, will succeed Prof. Erismann in the chair of hygiene in the University of Moscow. Dr. S. Bianchi has been appointed full professor of anatomy at Vienna, and Dr. B. Boccardi associate professor of microscopical anatomy in the University at Naples.

DISCUSSION AND CORRESPONDENCE.

COMPARISON BETWEEN THE USE OF FIXED AND MOVABLE CIRCLES, IN THE DETERMINATION OF DECLINATIONS BY MERIDIAN CIRCLE.

One advantage claimed for the use of a movable circle is, that it tends to eliminate the effect of graduation errors.

This effect will not be entirely eliminated by any number of changes in the position of the circle; but considering it as one of the sources of accidental error, the mean of a large number of observations will be affected by the mean of the errors of graduation for the increased number of divisions.

The relation of this error, to that due to other conditions, should also be considered; and in establishing the advantage of using the movable circle, in so far as graduation errors are concerned, one should be confident that no other sources of error are introduced.

In dealing with instrumental errors it is undoubtedly sounder policy to arrange observations so that they may be eliminated, rather than to determine the effect of such errors and correct for them.

But this policy refers to errors that can be actually eliminated, and without introducing others of unknown character or amount. Where both methods may be used, actual elimination of error, and, its determination and subsequent correction, the advantage is recognized, in the knowledge thus gained of the general laws governing errors and their correction.

In the case of a fixed circle the instrument is a homogeneous one throughout a series of observations, which may extend over many years. The laws of flexure may be studied by consecutive determinations, as part of a united series; and, in general, the performance of the instrument can be investigated, under the varied conditions arising from extended use, with the certainty that some errors are truly systematic in character.

With a movable circle there is the advantage of variation of conditions, which may produce results nearer the truth, in the average, by absence of certain systematic errors.

It will always be a matter of judgment based upon experience, whether one can deal better with results affected by systematic errors, or with observations in which they are replaced by accidental ones.

In practical observing one method is usually adopted for general work. While there are other conditions that may determine which method will be used, a comparison of their respective accuracy is not without interest, using such material as may have a bearing upon such a test.

For the purposes of illustration the probable error of graduation, for the mean of four divisions, may be assumed to be $\pm 0''.15$, the value obtained in the measurement of the 1° arcs, of the Repsold Meridian Circle of the Lick Observatory. If this error were entirely accidental, throughout, a reading made upon two adjoining divisions should have a smaller error; but as there appears to be evidence of a periodic character in the graduation, this value may be adopted for the present comparison.

Representing by g the *probable error* due to graduation, for the general case of a measure of zenith distance we should have to consider the error of the Nadir reading, and g would be $\pm 0''.21$.

With a fixed circle, however, if the value of the latitude, used in determining star declinations, is that obtained by observations of standard stars with the same instrument, the graduation error of the Nadir reading is actually eliminated from the results. Or, if when the instrument is reversed the same divisions come under the microscopes at the Nadir reading, the graduation error of those divisions is then eliminated from the measurement of any particular zenith distance in both positions. Under these conditions, the probable error g of a determination of a star's declination, by means of reading on

the Nadir will be $\pm$ 0″.15 for one position,
$\pm$ 0″.10 for both positions,
quantities which will not be diminished by an increase in the number of observations.

In the use of a movable circle, since new divisions are brought under the microscopes for the Nadir reading, each measure of declination will be affected by the probable error g of $\pm$ 0″.21.

The mean of four observations would have the probable error g of $\pm$ 0″.10, whether made in one position of the instrument or in both, By increasing the number of observations the movable circle would gain in accuracy over the fixed circle, in so far as this source of error is concerned. Thus, for eight observations, four made in each position of the instrument, for the fixed circle g would be as before $\pm$ 0″.10, while for the movable circle g would be $\pm$ 0″.08.

For differential determinations of declination the result, in both cases, will be affected by the probable error of graduation for the mean of the stars used as standard. If eight fundamental stars are used, the probable error g of the mean would be $\pm$ 0″.05, and the probable error g in the resulting declination would be $\pm$ 0″.16, from one observation.

With the fixed circle in both positions of the instrument the declination would have g equal to $\pm$ 0″.11.

The movable circle would give g,
for two observations $\pm$ 0″.11,
for four observations $\pm$ 0″.08,
and for eight observations $\pm$ 0″.06.

The above treats of a movable circle shifted for each night of observation. The custom of changing the position at stated intervals will have an advantage, only, in bettering the determination of stars observed as standard over long periods.

In order to obtain a more complete comparison, it will be necessary to combine the effect of graduation error with the accidental error from other sources. The purely accidental error may be assumed to be $\pm$ 0″.25 for one observation, including that of the determination of the reference point, by either standard stars or nadir readings. While it may be smaller in some cases, this value can be used as a basis of comparison.

The probable errors of declinations, determined with fixed circle and with movable circle, by both methods, would be predicted as follows:

	Nadir.	Differential.
	″	″
Fixed Circle:		
One position, 2 observations.....	±0.23	±0.24
4 "	±0.19	±0.20
8 "	±0.17	±0.18
Fixed Circle:	″	″
1 observation in each position....	±0.20	±0.21
2 " " " "	±0.16	±0.17
4 " " " "	±0.13	±0.14
	″	″
Movable Circle: 2 observations....	±0.23	±0.21
4 "	±0.16	±0.15
8 "	±0.12	±0.11

With an increase in the number of observations the movable circle would gain slightly. But, on the whole, it is doubtful whether the gain is not more than compensated by the advantages of having a permanent relation between circle and telescope. Some of these advantages become apparent when old observations are to be discussed for light upon some of the refinements of investigation. This permanency and consistency give a definite basis to work upon, when treating methods or results.

As an individual illustration, since the usual method of determining telescope flexure includes the sine term of the circle flexure, this last does not need to be independently measured; the effect of both may be determined, and their laws studied together. With a movable circle the flexure would need separate treatment for each position.

This comparison has been suggested, in part, by a note in this JOURNAL, in which the preference for the movable circle is indicated; and the utility of the measurement of Division error is questioned. (H. J., SCIENCE, Jan. 31.)

The actual measurement of errors of graduation would, presumably, replace those errors by the probable uncertainty of the measurement. With the method employed for this instrument, the probable error of the measurement of the 1° arcs is less than $\pm$ 0.″04.

Since each division may be measured, as has been done thus far, from two others, the probable error can be kept within small limits by making a sufficiently large number of measures. Practi-

cally it would probably increase as the subdivision of arcs is carried on. There are some statements in the note referred to, which appear to be misleading. To quote:

"Even if the division error of any given line could be determined with complete precision with the telescope pointed at the zenith, this division error would not hold true when the telescope is pointed elsewhere. Nor is this brought about by flexure alone. It is found that if we determine the division errors of a straight scale, these errors are completely changed when the scale is reversed end for end. No doubt unavoidable difference in the illumination and the eye of the observer are responsible for these unfortunate facts. But facts they are, and the cause of much wasted labor."

While the measurement of the division errors of a straight scale might not hold true if the scale were reversed end for end, this apparently damaging condition has nothing whatever to do with the measurement of the division errors of such a divided circle, since it cannot possibly be reversed; but is always read, facing it, in the same position.

As the instrument is moved to various settings, any single division passes under the various microscopes, and is read at various inclinations to the vertical, under various conditions of illumination, and to make the illustration as wide as possible, by various observers. The reading at any microscope will be affected by all the conditions of phase of that microscope, and by the personal equation of the observer, which may be, and probably is, peculiar to that microscope.

But there is no reason that these conditions should differ for the various divisions, which come in succession under the same microscope, or set of microscopes. In every case of star observation, or of determination of graduation error, the difference is measured between a reading of the circle at the required setting, and some standard reading.

Personal equation and phase should affect each reading alike, and should be eliminated from the results.

As to the effects of differences in the illumination and the eye of the observer, if they exist, they must be equally injurious to all observation with this instrument, as, in fact, they must be in every class of observing. Such sources of error fall within the class admitted as accidental; with proper care and well designed illumination, they are not believed to be large enough to invalidate the results obtained with fine instruments in astronomy of precision.

R. H. Tucker.

Lick Observatory.

SCIENTIFIC LITERATURE.

Elements of Geology, a text-book for colleges and for the general reader. By Joseph Le Conte. Fourth edition, revised and enlarged, with new plates and illustrations. New York, D. Appleton & Co. 1896.

For nearly twenty years Le Conte's Elements of Geology has stood side by side with Dana's Manual in the working libraries of American geologists and teachers. It has found equal favor in the class-room and the study room, and has been widely read by the cultured layman. Holding this enviable position, it needs neither introduction, encomium nor criticism; but the appearance of a new edition may rather serve as an occasion to enquire what are the qualities on which its success depends.

I conceive that one of the first of these is a wise choice of material. The author is fortunate in possessing the power to select the more essential and ignore the less essential, so that the principles he expounds are not obscured by clouds of detail. Moreover, he devotes all his space to his proper theme, the science of geology, assuming, on one hand, that the reader has all necessary knowledge of physics, chemistry, astronomy, meteorology, biology, and even mineralogy, and not undertaking, on the other, to teach him either the technology of the professional geologist or the economic application of geologic results.

Of equal importance, perhaps, is the order of presentation, which deviates somewhat from the strictest system so that it may follow lines of least resistance. One who writes on a complex subject is always embarrassed by the fact that the easy explanation of each part seems to require the previous explanation of some other part; and in geology this contest for priority lies between processes of change and the struc-

tures, etc., which result from change. Le Conte gives a general outline of processes under his first heading, Dynamical Geology, but reserves much of their amplification to be introduced under Structural Geology in explanation of the principal products of change, namely, rocks, rock structures and mountains.

A few subjects are developed by the presentation and discussion of alternative theories, and these serve the important end of illustrating the method of scientific progress. Others are not carried beyond the safe ground of established result, and yet others are confessedly treated from the personal standpoint of the author, who supports his views by argument. For the professional and critical reader the passages last mentioned are doubtless the least convincing and satisfactory of the treatise, but they strengthen it in another way by exhibiting the author in his proper character as an able investigator and original thinker. Moreover, the literary style, which, albeit, is ever lucid and direct, often assumes the characteristics of a spoken address, so that the reader is distinctly conscious of the writer's individuality.

Only five years have elapsed since the last revision of the book, and the amount of change now introduced is not large, though enough to require a complete resetting of type. Perhaps it is best expressed by saying that in a total of one thousand figures sixty are new. Among the subjects amplified are earthquakes, igneous rocks, geologic climates, trilobites and Mesozoic and Cenozoic vertebrates. The Cambrian is given higher taxonomic rank than before, but the Algonkian is not recognized.

It is, of course, easy to pick flaws, for the broadest investigator and most scholarly student is not omniscient. Our author tells us that tideless waters are essential to the production of deltas, and the flux and reflux of tides to the creation of estuaries. Even Chesapeake Bay and the fiords of Norway are ascribed to tidal action, and the function of submergence in the origination of estuaries is almost ignored. Not only is the old view retained, that gneiss is a stage in the making of granite, and that the Archean consists essentially of metamorphosed sediments; but no mention even is made of the view prevalent among modern investigators, that gneiss is usually altered granite, and that the Archean complex consists largely of altered igneous rocks. The student of mountain dynamics could wish that the author's hypothetic explanation of the Basin ranges were stated with less confidence; the physiographer that crude sketches by early explorers of the Grand Canyon of the Colorado and the Mauvaises Terres were replaced by more realistic drawings; and the biologist that a more modern classification of living forms were employed.

But these and other blemishes may freely be forgiven to a book that sets forth the broad generalizations and fundamental principles of its particular science in orderly and attractive form, and at the same time illustrates and embodies the true and essential spirit of all science.

G. K. GILBERT.

The History of Mankind. By PROF. FRIEDRICH RATZEL. Translated from the second German edition by A. J. Butler, M. A. With introduction by E. B. Tylor, D. C. L., with colored plates, maps and illustrations. Vol. I. pp. 468. London and New York, Macmillan & Co. 1896. Price, $4.00.

Prof. Ratzel, of Leipzig, has achieved a well-earned reputation as a writer and teacher of geography in its relation to man and human culture. His chief work, 'Völkerkunde,' appeared in 1885, and some years later a second edition was called for, of which the above is a translation. It is a book intended for the general public rather than the scientific student, and in that respect will prove less satisfactory to the latter than, for instance, Prof. Waitz's 'Anthropologie.' Ratzel does not give references to authorities for his statements, thus avoiding notes and the discussion of small points, but leaving his reader without an aid to further researches. His style is clear and pleasant, and the translator has, as a rule, done his part of the task cleverly, and given an easy English rendering to the original. The illustrations are abundant, accurate and well printed, and aid materially in bringing the descriptions home to the mind.

This first volume includes two 'Books,' one on the principles of Ethnography and the second on 'The American-Pacific Group of

Races,' that is, the Polynesians, Australians and Malays.

It may be appropriate here to ask why the translator renders 'Völkerkunde' in the title of Book I. by 'Ethnography,' while the work itself he christens 'The History of Mankind,' which it is not in any sense of the phrase, nor is it so called in the original.

The author sets for himself the task of describing mankind 'as we find it to-day throughout the earth;' that is, he confines himself to the ethnography of the present age, and does not deal in history or archæology. His remoter aim is 'to demonstrate the cohesion of the human race.' In this particular field he belongs to the historic school, and where he finds similarities, *e. g.*, in religions of American, African and Australasian tribes, which he cannot explain, he 'predicts' (p. 40) that they 'will be found germs of survivals of Indian or Egyptian tradition.' This antique explanation (why did he not say Hebrew tradition?) will no longer avail in the light of modern psychologic science applied to ethnography.

In his detailed descriptions the author has been careful to present an accurate perspective of the life of the ruder races. He aims to give them their just position in the scheme of the world, and safely steers between the rocks of indiscriminate praise and under-valuation. He is constantly on the alert to point out the connection between special forms of culture and the natural conditions which give it color and form. His work is one which will be hailed with pleasure by all interested in the diffusion of knowledge regarding man, and it may be recommended as much the best in the domain which it treats now accessible in English.

D. G. Brinton.

University of Pennsylvania.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES, OCTOBER 5, 1896.

At the meeting of the Academy, October 5, 1896, the following gentlemen were nominated as honorary members of the Academy, and on ballot were duly elected: Prof. James J. Thomson, Cavendish professor of physics in the University of Cambridge, England; Prof. Felix Klein, professor of mathematics in the University of Göttingen, Germany; Prof. Henri Moissan, of the University of Paris, France.

On the organization of the Section of Astronomy and Physics, Prof. J. K. Rees stated that the work of the Columbia College observatory upon the variation of latitude had been continued during the past summer in such a manner that forty pairs of stars were observed every two weeks. This is a part of the general programme to continue these observations for the next two or three years until the observatories contemplated by the National Geodetic Association should be established. Prof. Rees also referred to the work of Dr. Davis, of the Astronomical Department of Columbia, who is about to undertake the reduction of the Piazzi catalogue devoting himself especially to the reduction of declinations.

Dr. H. Jacoby reported on the proceedings of the meeting held at Paris to consider the astro-photographic star charts. He stated that the 36,000 plates to be used in the catalogue of stars down to the 11th magnitude have nearly all been made, and the work measuring these plates is well under way. The Postdam measurements are practically ready for publication. The Paris and Greenwich reports will be ready in from five to seven years. The limit of accuracy in all of this work is about $0''.2$ of arc. This catalogue is expected to contain about 2,000,000 stars.

Wm. Hallock,
Secretary of Section.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, SEPTEMBER 29, 1896.

Dr. S. G. Dixon communicated an experiment that tends to establish the spore formation in the Tubercle bacillus. A glass tube was made six inches in length, one-half inch in diameter, having two bulbous enlargements situated one and one-half inches apart. *Agar Agar* nidus was placed in these hanging enlargements and the tube plugged at either end with cotton. After thorough sterilization the tube was placed in the Dixon manipulating chamber, when the cotton was removed from one end and the *Agar Agar* in one of the culture mediums inoculated with a growth of the tubercle bacillus. Then the tube was carefully replugged and

capped with rubber. It was held in a horizontal position and placed in a brood-oven where it remained for three weeks, at the end of which time a growth was apparent on the *Agar Agar* which had not been inoculated, thus demonstrating that something lighter than the bacillus itself had floated in an air-tight chamber at least one and one-half inches distant, warranting a belief in the existence of spores.

October 6th, Dr. Goldsmith called attention to the trap formations in Pennsylvania, more particularly to that near Pottstown, known as 'Ringing Rocks.' Referring to the contention as to whether they were of plutonic or volcanic origin, he said that he had been examining them for several years and was now convinced of their volcanic origin. In support of this view he described the general land configuration surrounding these formations, which he thought in some instances indicated the former existence of a crater, while in others the outflow had been through fissures. In further confirmation he exhibited a number of rock specimens and microscopic sections of the same. The subject was debated by Profs. Pilsbry and Frazer and Dr. Rand.

Theodore D. Rand presented specimens of mica schist from the River road, in Fairmount Park, Philadelphia. The nodules resemble very imperfect andalusite crystals, but appear on examination to be almost wholly quartz with a little kyanite or sillimanite, resembling closely those described by the late Dr. George H. Williams, in the 15th annual report of the United States Geological Survey as occurring on Sligo Branch (probably Fairfax county, Virginia,) and as suggesting metamorphism of included fragments.

Papers under the following titles have been recently presented for publication:

'Fossil bones of Birds and Mammals from Grotto Pietro Tamponi and Grive St. Alban.' By R. W. Shufeldt, M. D.

'Contributions to the Zoology of Tennessee, No. 4, Mollusks.' By Samuel N. Rhoads and Henry A. Pilsbry.

'Mammals collected by Dr. A. Donaldson Smith during his expedition to Lake Rudof.' By Samuel N. Rhoads.

'The Hymenoptera collected by Dr. A. Donaldson Smith in Northeast Africa.' By William J. Fox.

EDWARD J. NELSON,
Secretary.

THE TORREY BOTANICAL CLUB.

THE first fall meeting was held on Tuesday evening, October 13th, 33 persons being in attendance. Eight new members were elected. Dr. Britton reported that the field meetings during July and August had been usually well attended. Arrangements were made for reprinting several exhausted numbers of the *Bulletin*, so that complete sets can again be supplied. Specimens of the Russian thistle, collected on Captain's Island, off the Connecticut coast, were exhibited. The members interchanged accounts of their summer field experiences. Specimens of fleshy fruits were exhibited which had been preserved perfectly well since the early part of May in a 4 per cent. solution of formalin.

H. H. RUSBY,
Secretary.

SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, OCTOBER.

Trimetaphosphimic Acid and Its Decomposition Products: By H. N. STOKES. The author has defined a metaphosphimic acid as a metaphosphoric acid in which one-third of the oxygen is replaced by an equivalent number of imide groups. The complexity of these acids is so great that in most cases at least four forms are theoretically possible. Reference is made to the work of several investigators in the same field, and it is pointed out that the results obtained by Gladstone are capable of a different interpretation from that which he gave, and that the acid under investigation may have been trimetaphosphimic acid. The constitution of trimetaphosphimic acid depends on that of the chloronitride $P_3N_3Cl_6$. The author considers that the methods of formation and decomposition can be most readily explained on the assumption that the nucleus consists of a symmetrical ring of three phosphorus and three nitrogen atoms. Replacement of the chlorine by hydroxyl and a transformation into a tantomeric form would produce the trimetaphosphimic acid. It can be easily identified by its salts, several of which are quite characteristic. If a solution of the acid is decomposed by a

strong mineral acid the final products are orthophosphoric acid and ammonia. If, however, the action is limited, a series of intermediate acids is formed. Methods were devised for obtaining these acids in pure condition and a number of their salts were made and studied.

On Certain Derivatives of Trichlordinitrobenzol: By C. Loring Jackson and W. R. Lamar. The results of an investigation of the behavior of various reagents with tribromdinitrobenzol have been published in this Journal. In the present paper the author compares those results with the ones obtained when trichlordinitrobenzol is used. With aniline the reaction in both cases is similar, the product formed being trianilidodinitrobenzol. When sodic ethylate is used, the replacement of two bromine or two chlorine atoms leads to the formation of similar compounds; but the replacement of the third does not follow the same rule, nor is the reaction with malonic acid ester similar in the two cases.

Camphoric Acid: By W. A. Noyes. Results obtained by this author have led him to reject the formula proposed for camphor by Bredt, which is the one most generally accepted, and that proposed recently by Tiemann. The evidence against the latter is found in the fact that the rate of esterification of two compounds, which should according to the view of Tiemann be the same, is very different. He has also subjected Armstrong's formula to a synthetic test and finds that his formula for camphor is not true. One of the products obtained in the course of this investigation, dihydro-cis-campholytic acid, has been studied by E. B. Harris, and the results are incorporated in this article.

On Diacid Anilides: By H. L. Wheeler. Diacid anilides may be divided into two classes, the first consisting of those which have identical acid groups, and the second of those with unlike acid groups. The second class have not been obtained by the same methods as the first; but the author of this paper has devised a method for their formation, which consists in treating silver or mercury acid anilides with an aliphatic acid chloride, when the action is similar to the one in which benzoylchloride is used. A number of these mixed diacid anilides were prepared and studied. When silver and mercury salts of the amides were used, imidoethers were formed and not diacidamides, as was expected.

Iodometic Determination of Selenious and Selenic Acids: By J. F. Norris and H. Fay. This method depends on the reaction between sodium thiosulphate and selenious acid in the presence of hydrochloric acid. If the selenious acid in the presence of hydrochloric acid is treated with an excess of sodium thiosulphate, and then titrated back with iodine, very satisfactory results can be obtained. The complete reaction which takes place here is as yet unknown. Selenic acid must be reduced by boiling with hydrochloric acid before the selenium can be determined. Mixtures of the two can be easily analyzed by first determining the selenious acid and then the total after reduction of the selenic acid.

J. Elliott Gilpin.

NEW BOOKS.

An American Text-Book of Physiology. Edited by William H. Howell. Philadelphia, W. B. Saunders. 1896. Pp. 1052.

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